Open Water Diver Course Presentation Notes

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2013

Published by
PADI
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Rancho Santa Margarita, CA 92688 – 2125

2013

Knowledge Development One

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Outline

I. Introduction to the PADI Open Water Diver Course

A. [Introduce yourself and your staff. Welcome students to the course and provide some background about yourself. Have students introduce themselves and encourage a relaxed atmosphere.]

B. Training and Certification

- ***What does certification in this course mean? Why is training important in scuba diving?***

1. Training is important in diving because
   a. there are potential hazards you must learn to avoid, reduce and/or manage.
   b. there are risks you must accept.
   c. it enables diving to be rewarding and meaningful.
2. Certification shows that you have met the training requirements for a specific course.
   a. Dive centers and resorts require proof of certification before you can rent scuba equipment or have your scuba cylinder filled.
   b. Further training and certification are also important in your growth as a diver because they expand the places, activities and technologies you can use.
3. As a PADI Open Water Diver, you will be trained to a maximum depth of 18 metres/60 feet (or the actual depth you reached, if shallower).
   a. You'll also be qualified to dive in conditions as good as, or better than, those in which you trained, within the no stop limits of your dive computer or tables (you'll learn about these limits in Sections Four and Five.
4. A PADI Scuba Diver may dive under PADI Instructor or Divemaster supervision as deep as 12 metres/40 feet.

C. Course Overview, Schedule and Requirements

- ***What are the three basic parts of the PADI Open Water Diver course? What is the purpose of each parts?***
- ***What general schedule will your instructor follow in conducting your PADI Open Water Diver course?***
- ***What are the requirements for taking the course and for earning your certification?***

1. The PADI Open Water Diver course consists of three parts: Knowledge Development, Confined Water Dives and Open Water Dives.

a. Knowledge Development teaches you about principles, concepts and terms that you need to know for safety and so you can enjoy diving.
b. During the Confined Water Dives, you learn and practice scuba skills in a pool or water with pool-like conditions under direct instructor supervision. You also practice applying the principles and concepts you learn in Knowledge Development.
   - One of the most fun parts is making minidives
   - Minidives are short simulated dives – from beginning to end – that let you go through the same steps you follow when you make open water dives.
c. The Open Water Dives are dives you make with your instructor at dives sites suited to beginning divers. During these dives, you practice, apply and demonstrate what you learn in Knowledge Development and during the Confined Water Dives.

2. There are five Knowledge Development sections, each of which corresponds to one of the five Confined Water Dives. There are four Open Water Dives (two for PADI Scuba Divers) that you complete over at least two days (one for PADI Scuba Divers).

[NOTE: Go over the planned course schedule with students, along with times, locations and other logistics.]

3. Prerequisites for scuba diving
   a. Basic swimming skills
      - 200 metre/yard swim or 300 metre/yard mask, snorkel and fins swim
      - 10 minute float (prior to Open Water Dive Two)
   b. Minimum age
      - 10 years old to start the course
      - Local regulations may specify a higher minimum age.
      - 10-14 year olds earn a PADI Junior certification.
      - After certification, 10-11 years old must dive with a parent/guardian or PADI Professional to a maximum depth of 12 metres/40 feet, and 12-14 year olds must dive with a adult certified diver.
   c. Medical fitness – as a prudent precaution, the Medical Statement screens for conditions that should be evaluated by a physician.
      - For your safety, answer all questions honestly and completely.
      - If you answer "yes" to any condition, your physician must approve you for diving by completing and signing the statement prior to any inwater training.
      - In some areas, local law requires a physician's signature in all cases.
4. Paperwork

[NOTE: Distribute and complete all outstanding paperwork.]

5. Requirements and logistics

[NOTE: Inform the class of any remaining requirements -- equipment they must provide, outstanding fees, etc.]

D. Getting the Most Out of the Course

- ***What do "performance-based learning" and "student-centered learning" mean? How do they relate to taking PADI courses?***
- ***How can you learn most effectively during Knowledge Development and the Confined Water and Open Water Dives? How does getting your PADI Resort or Dive Center to help you with your equipment help you learn to dive and enjoy diving better?***

1. The PADI Open Water Diver course is designed to be an enjoyable and rewarding learning experience. Understanding the instructional philosophy, how to prepare for each session and how to approach the dives makes learning more efficient and rewarding.
2. PADI courses apply performance-based learning and student-centered learning.
   a. Performance-based learning means that you progress through the course by demonstrating that you meet specific learning objectives. You complete the course by showing the instructor that you meet all the requirements.
   b. Student-centered learning means the course, materials and your instructor address how you learn most effectively, at your pace.
   c. The important thing is to meet the requirements, not how long it takes.
      - People learn at different rates.
      - It only matters that you can perform your scuba skills correctly and reliably. It does not matter whether a skill takes one try or 10 to learn.
   d. You must meet the requirements for certification, but your instructor realizes that some people may need more time to do so than others. You pay for the training, but you earn the certification.
      - Student-centered learning helps you meet these requirements in the ways that work best for you.
      - Student-centered learning means that your instructor wants to know that you have reasonable confidence and comfort as well as capability.
3. You learn most effectively during Knowledge Development sessions by
   a. paying attention to the learning objectives (phrased as questions you must be able to answer).
      - Look and listen for the answer to each question. You should be able to answer each learning objective question in your own words.

- Use the exercise questions to guide your learning.
- Complete any assignments your instructor gives (like filling out Knowledge Reviews, etc.) before each session. These help you meet the learning objectives.

b. arriving on time.

c. letting your instructor know immediately about any difficulties you may be having.

d. participating in discussions, asking questions and answering those from your instructor.

4. You can learn most effectively in the Confined Water Dives by

a. arriving with your personal equipment (mask, fins, snorkel, etc.) prepared, as directed by your instructor.

b. treating these dives as practice open water dives.

- Practice all the habits that apply to open water diving; e.g., keep your mask on and breathe from your snorkel or regulator at the surface.
- Avoid habits that don't apply to open water; e.g., the ocean doesn't have a side to hang onto, so don't hang on to the pool sides. Use your equipment to float.

c. letting your instructor know if you wear contact lenses. Do without them if you can, but wear them if you need them to read gauges, etc.

d. paying attention to your instructor's skill demonstrations and noting the emphasized details.

e. remembering that there are no arbitrary skills in this course. Everything you learn has a real-world purpose in diving. If you don't know why you would do something you're doing, ask!

f. developing good habits. This is important because what you do by habit is what you tend to do when you have to deal with a problem. Start developing good diving habits in confined water.

g. being in good health. It's your responsibility to postpone diving if you don't feel well, or are ill or injured, until you're back to normal health.

h. telling your instructor how you feel.

- Your instructor can tell if you can perform a skill properly, but can only be certain that you're comfortable and confident with your skills if you say so.
- It's normal to be a bit nervous when you start, but you should be gaining confidence.
- Even if you can perform every skill competently, if you want more experience time before moving on, tell your instructor so you can schedule more time.

5. You can learn most effectively in the Open Water Dives by:
    a. listening to your instructor's recommendations about what to wear and how to prepare.
    b. if you're prone to seasickness and will be diving from a boat, consulting your physician as appropriate about seasickness medication.
    c. arriving adequately rested and fed. Diving is a physical activity, so be physically ready to focus on the experience and what you're doing.
    d. paying close attention to the predive briefings, doing your part in planning each dive, and speaking up if you don't understand something.
6. You learn more effectively and enjoy diving more by getting your PADI Resort or Dive Center to help you choose your equipment as soon as possible.
    a. Diving is a technical activity – it is impossible without equipment.
    b. You will learn a lot about equipment in this course, but there are hundreds of features and options available in your gear, as well as new models and improvements introduced regularly. It is impossible for a course to include all of these.
        - The professionals at your PADI Resort or Dive Center are the best way to sort through the choices you have to get the best gear for you, your budget and the types of diving you want to enjoy.
        - These professionals also keep up on the latest improvements, changes and newest options for different types of equipment.
    c. Proper fit is important for the best equipment function, and for your comfort while diving. Being comfortable in your kit makes diving more enjoyable, and speeds learning by eliminating distractions.
        - Professional guidance is the best way to get a proper, comfortable fit.
        - As you'll learn in more detail, most pieces of equipment require you to actually try them on to get the right fit. Your local PADI Resort or Dive Center is the place to do this.
    d. Ideally, learn to dive in your own gear.
        - Equipment you choose with professional guidance usually has the best possible fit, and the most comfort.
        - Your instructor will teach you how to tailor and refine your equipment to your personal preferences. This adds to the learning experience and enjoying diving.

E. Getting the Most Out of Being a Diver

- ***What are 11 reasons to dive?***
- ***What are five things you can do before the end of the course to help you continue to enjoy and be involved with diving after certification?***

1. During this course, you are becoming something new – a scuba diver. Assuming you're not planning to just try it and quit, think about why you want to dive, how to continue growing as a diver, and what helps you keep enjoying diving.
   a. You already have reasons why you want to dive, or you wouldn't be here. However, there are likely reasons you've not considered, which, with experience, may become more important than what brought you to diving in the first place.
   b. Common reasons and activities for going diving include:
      - adventuring and exploring.
      - enjoying and observing nature.
      - spending time doing something wonderful with friends and/or family.
      - getting out on the water as well as under it.
      - taking photos and videos.
      - investigating sunken ships.
      - taking on new personal challenges.
      - becoming familiar with new technologies.
      - making new friends and joining new social circles.
      - making a difference in environmental preservation and conservation.
      - enjoying a world that differs markedly in many ways from the world above the surface.
2. Transitioning from learning to dive to being a diver means getting into the diving lifestyle. If you're like most divers, you will enjoy diving more and stay involved with it if you do one or more of the following things before you complete the PADI Open Water Diver course:
   a. Join and participate in your local dive center's dive club and/or social events.
   b. Enroll in a PADI course that introduces you to an activity you'd like to try, like underwater photography, shipwreck diving, etc. (you can enroll now, but you must successfully complete your PADI Open Water Diver certification before taking most specialty diver courses).
      - PADI Specialty Diver courses offer a wide range of activities.

      [NOTE: Briefly mention the courses you have coming up.]

      - The PADI Advanced Open Water Diver course lets you try five special activities.

- These types of courses are a great way to go diving while experiencing new adventures, learning new skills and meeting new people.

c. Sign up for a dive trip that involves travel, but also plan a local dive outing.
d. Invest in your first scuba equipment – regulator, BCD, dive computer and/or wet suit/dry suit.
e. Take part in a local aquatic world education or cleanup project or event.

[**NOTE:** Explain your operation's involvement with Project AWARE.]

3. Your PADI Dive Center or Resort plays an important role in your involvement with diving because it brings everything into one place. The professionals there can
   a. connect you with other divers.
   b. can recommend and/or book dive travel.
   c. assist in equipment choices, investment and long-term care/repair.
   d. provide PADI Diver courses that expand what you can do as a diver.

F. A World of Diving

- ***Why should you seek an orientation, supervision and/or additional training when diving in a new dive environment?***

1. One of the great things about diving is that you can enjoy it around the world in many different environments.
2. During this course, you will learn and apply the foundational skills of diving in a local environment using appropriate techniques.
3. Different environments may require different techniques and equipment.
   Example: Cool environments may call for using a dry suit – you want appropriate training for this.
4. When diving in a new environment or unfamiliar dive site, get a local orientation, guided dive and/or additional training (which is most appropriate depends upon how different the new site is from those with which you're familiar). Doing this:
   a. helps you enjoy diving by assuring you are comfortable and know what to look for that's interesting, special or unique – especially when you're new to diving.
   b. helps ensure you have the right equipment.
   c. informs you about local hazards of which you may not be aware.
   d. teaches you any special techniques you need.
5. When visiting a new dive site/environment, check with your local PADI Resort, Dive Center or Professional for recommendations on the orientation/supervision/training that's appropriate.

a. The PADI Discover Local Diving orientation is designed specifically for orienting certified divers to a new location.

II. Being a Diver 1

1. Diving is exciting because you experience new sensations. These result because the underwater world has properties that differ from the terrestrial world. During the course, you'll learn about learn these, including:
   a. How water creates pressure and how you adjust for it.
   b. Why you can float, sink or be almost weightless in water, and how you control it.
   c. How seeing, hearing and moving differ in water.
   d. Why water absorbs heat and how you stay warm.
   e. How these principles relate directly to your safety and enjoyment as a diver.

A. Water Pressure and Air Volume Effects

- ***What is the relationship between your depth in water and the pressure?***
- ***What is the pressure change for each 10 metres/33 feet of depth change?***

1. Pressure increases as you descend in water.
   a. At the surface, you are under pressure. The weight of the air in the atmosphere exerts this pressure. The amount of pressure at sea level is one bar or atmosphere (abbreviated ata).
   b. When you go underwater, the pressure increases because water has weight. The water's weight combines with the atmosphere's weight.
   c. Water is much denser and heavier than air. 10 metres/33 feet of water exerts as much pressure as the entire atmosphere of air.
   d. Therefore, the pressure increases by one bar/ata for each 10 metres/33 feet you descend. Likewise, it decreases one bar/atmosphere for every 10 metres/33 feet you ascend. So:
      - At 0 metres/feet, the total pressure is 1 bar/ata.
      - At 10 metres/33 feet, the total pressure is 2 bar/ata – one of air and one of water.
      - At 20 metres/66 feet, the total pressure is 3 bar/ata.
      - At 30 metres/99 feet, the total pressure is 4 bar/ata.
      - The total pressure is often called the absolute pressure. An absolute pressure of zero is a vacuum.

- ***What is the relationship between pressure, and the volume and density of air?***

2. The volume and density of water do not change when the pressure changes.
   a. Water cannot be compressed. Your body tissues are mostly made of water, so you don't feel pressure changes on most of your body.

b. Pressure changes do, however, change the volume and density of air (we'll refer to air, but these principles apply to any gas).
   - Increased pressure reduces the volume by compressing the gas molecules closer together.
   - The density increases because all the gas molecules are still there, but packed into a smaller area.

c. This is one of the most important principles you learn as a diver because it affects all the air spaces in, or in contact with, your body: your ears, sinuses, lungs, mask and (if used) dry suit. You'll also learn that this principle affects controlling your buoyancy, how long your air supply lasts and some important safety rules.

- ***If you take an air volume from one depth to another depth, how much will the volume and density change?***

3. The change in the volume and density of air relates directly (proportionately) to the change in pressure.
   a. If you go from the surface to 10 metres/33 feet, you double the pressure to 2 bar/ata (1 air, 1 water). When the pressure doubles:
      - the air volume halves
      - the air density doubles

   b. If you go from the surface to 20 metres/66 feet, you go from 1 bar/ata (1 air) to 3 bar/ata (1 air, 2 water). When the pressure triples:
      - the air volume reduces to one-third (1/3)
      - the air density triples (becomes three times denser)

      Examples: If you descend with a balloon inflated with 3 litres of air at the surface, at 20 metres/66 feet, it will be inflated with 1 litre. If the balloon has 3 cubic feet at the surface, it will have 1 cubic foot at 20 metres/66 feet. Whether you measure in litres, cubic feet, gallons, etc., the relationship is the same.
      - The air will be squeezed into a volume one-third the original size, so it will be three times as dense.

   c. The same relationship applies when you decrease pressure. If you have a volume of air at 10 metres/33 feet and take it to the surface, you take it from 2 bar/ata to 1 bar/ata.
      - the air volume will double.
      - the air density will become one half.

   d. This predictable relationship between pressure and air (gas) volume and density exists with every depth change.
      Example: What would happen to the volume and density of 1 litre of air brought to the surface from 30 metres/99 feet?
      - The pressure at 30 metres/99 feet is 4 bar/ata (1 bar/ata for each 10 metres/33 feet of water, plus 1 bar/ata from the atmosphere).

- The pressure at the surface is 1 bar/ata, so the pressure is 1/4th the pressure at 30 metres/99 feet.
- Therefore, 1 litre of air brought to the surface from 30 metres/99 feet will expand as you ascend, reaching 4 litres at the surface. The air density would be 1/4th the density.

Example: You fill a balloon with air and seal it at 10 metres/33 feet. What would you see happen to the balloon as you ascend? How could you prevent it?

- You would see the balloon expand and finally burst as the air stretches it past its failure point.
- To prevent this, you would unseal the balloon and let the expanding air escape.

B. Effects of Increasing Pressure on Body Air Spaces

- ***What three major body air spaces does increasing pressure affect as you descend?***

1. As you learned earlier, most of your body is made of water and therefore doesn't feel the effects of increasing pressure.
   a. Because air compresses and the volume decreases as pressure increases, body air spaces are affected by increasing pressure as you descend.
   b. Increasing pressure affects three major body air spaces as you descend.
      - ears
      - sinuses
      - mask

- ***What is a "squeeze"?***

2. As you descend, water pressure compresses the air in the air space. If you don't do anything to adjust for this, you can get a squeeze. A squeeze is discomfort and (if not corrected) injury caused as the pressure imbalance cause body tissues to push in toward an air space. It is caused by greater pressure outside an air space than inside it.
   a. Discomfort in the ears as you descend is an ear squeeze. It is caused by pressure pushing your eardrum and surrounding tissues inward.
   b. A pulling or sucking sensation on your face caused by an unequalized mask is a mask squeeze.
   c. Discomfort in your cheeks, central forehead and along the nose is a sinus squeeze.
   d. Other squeezes are possible, but not as common – more about these shortly.

- ***What is "equalization" and how do you equalize as you descend?***
- ***How often should you equalize?***

3. Fortunately, you can easily prevent squeezes. You do this by adding air

to the air spaces as you descend. This keeps their pressure equal with the outside pressure, so air spaces stay at their normal volume. This is called equalization.

a. To equalize your ears and sinuses, pinch your nose and blow gently against it. This sends air from your throat into your ears and sinuses.
b. Some people find that wiggling their jaws side-to-side and swallowing works.
c. To equalize your mask, blow air into it through your nose as you descend. (Note that this is why you can't use goggles for scuba diving – they don't enclose your nose, so you can't equalize them.)
d. Equalize every metre/few feet, before you feel discomfort.
    - If you wait until you feel discomfort, equalization may be difficult or impossible.
    - Diving isn't supposed to hurt. When you equalize as often as you should, you don't experience discomfort or pain.

- ***What should you do if you can't equalize? What can happen if you don't or can't equalize and keep descending?***

4. If you can't equalize, stop your descent immediately. Signal your buddy or instructor – they have no way of knowing you have an equalization problem unless you tell them. (Point to your ears. You'll learn hand signals and other communications shortly).
    a. Ascend slightly until the discomfort passes and try again. Be patient. After you equalize, continue your descent more slowly, equalizing more frequently.
    b. If you still can't equalize, discontinue the dive and try another day.
    c. Continuing to descend with unequalized air spaces can lead to serious injuries.
        - Ear injuries can include fluid accumulating in the middle ear, and eardrum rupture. Ear drum rupture while underwater can cause severe vertigo.
        - A mask squeeze can cause bruising around your eyes. While this is usually not serious and clears with time, its appearance is dramatic and may be alarming.
        - A physician should check serious squeezes to avoid long-term injury and complications. Eardrum rupture requires medical treatment.

- ***Why should you equalize gently?***

5. Equalize gently. Never attempt a forceful and/or extended equalization. A forceful, extended equalization can cause serious permanent injuries to your ears and hearing.
    a. Use short, frequent, gentle equalizations.
    b. If short, frequent, gentle equalizations don't work, stop your descent,

signal your buddy/instructor, ascend until the discomfort passes and try again as just discussed.

6. Equalizing is a skill that involves muscles. Like any skill that involves muscles, for most people it gets easier with practice.

- ***Why does congestion from a cold or allergy temporarily keep you from diving? Why should you never dive with ear plugs?***

7. Never dive with a cold or allergy that causes congestion.
   a. Congestion blocks normal air flow through body passages and may make equalization difficult or impossible.
   b. Using cold medications is not recommended. They can wear off during a dive and cause other equalization problems as a result (more about these shortly).
8. You never wear ear plugs while diving.
   a. Ear plugs create air spaces that you cannot equalize, so you never wear them while diving. (The only exceptions are special ear protectors, made specifically for diving that you can equalize).
   b. It is possible for a too-tight wet suit hood to seal against your ear and act like an ear plug.
      - If this happens, pull the hood away from your ear momentarily.

- ***What other body air spaces does increasing pressure affect? How do you equalize them?***

9. Increasing pressure may affect other body air spaces as you descend.
   a. Very rarely, an air space can develop in filled teeth and cause discomfort.
      - Stop your descent – you can't equalize this.
      - See your dentist to eliminate the space.
      - Regular dental checkups help avoid this problem.
   b. A dry suit holds a layer of air around your body during the dive.
      - You learn to equalize this space as part of learning to dive with a dry suit in the PADI Dry Suit Diver course.
      - If you will use a dry suit during this course, your instructor will show you how to equalize it.
   c. Your lungs are a large air space but you don't need to do anything special to equalize them other than breathe normally and continuously.
      - Scuba provides air at the surrounding pressure, so your lungs constantly equalize as you breathe.
      - When skin diving (breath-hold diving), your lungs compress as you descend, but they are designed to do this, so this is not an issue.
      - The only possible concerns are if you were to descend, after

exhaling completely, or if when skin diving, you were to dive very deep (60 metres/200 feet), holding your breath. These are unlikely situations for most divers.

C. Effects of Decreasing Pressure on Body Air Spaces

- ***What is the most important rule in scuba diving?***

1. As you learned, as pressure decreases during ascent, air expands. The increased air volume must exit body air spaces.
2. When you ascend and the pressure decreases, you do not normally need to equalize because expanding air exits your ears, mask and sinuses easily.
3. Expanding air is most important with respect to your lungs.
   a. Scuba equipment lets you breathe because it supplies air at the surrounding pressure.
   b. Your lungs are therefore at normal volume at depth.
   c. When you ascend, the air in your lungs expands. If you breathe normally, this is not an issue. Your lungs will maintain their normal volume.
   d. If during ascent you were to hold your breath, blocking your airway, your lungs would overexpand.
      - They would be much like a balloon filled and sealed at depth, which expanding air would burst during ascent.
      - Expanding air can cause serious lung overexpansion (lung rupture) injuries.
      - For this reason, the most important rule in scuba diving is to breathe continuously and never, ever hold your breath.

- ***What can happen if you don't follow the most important rule in scuba diving?***

4. Lung overexpansion injuries can force air into the bloodstream and chest cavities, resulting in severe injuries.
   a. Lung overexpansion can cause paralysis and death.
   b. Even slight pressure changes can cause this if you hold your breath – as little as a metre/2-3 feet.
   c. Treatment for these injuries is difficult, and usually requires recompression (being put back under pressure) in a chamber as soon as possible. However, diving commonly takes place several hours (or more) from a recompression chamber.
   d. Fortunately, while very serious, lung overexpansion injuries are among the easiest to avoid.
      - Breathe at all times and never hold your breath.
      - When the regulator is not in your mouth, exhale a slow, steady bubble stream so you don't hold your breath.
      - Do not dive with lung congestion, which can trap air in the lungs and cause overexpansion injuries.

- ***What is a "reverse block"?***
- ***What should you do if you feel discomfort in your ears, sinuses, stomach, intestines or teeth while ascending?***

5. Your other air spaces usually pose no problems during ascent, but in rare instances you can have a reverse block.
    a. A reverse block (also called a reverse squeeze) is caused by expanding air getting trapped in a body air space.
    b. It can be caused by using a decongestant to dive with a cold or allergy.
        - The decongestant wears off, trapping air in the ears and/or sinuses.
        - Again, do not dive with cold/allergy congestion, even with medications.
    c. Gas forming in the stomach/intestines can cause discomfort on ascent if it doesn't pass.
        - Avoid gas-producing foods prior to diving.
        - Avoid swallowing air while diving.
    d. A reverse tooth squeeze is very rare, but can result if air seeps into secondary erosion under a filling.
        - See your dentist for correction and to prevent the problem.
    e. If you experience discomfort in any air space during ascent, immediately slow or stop your ascent.
        - Descend a metre/few feet and give the trapped air time to work its way out.
        - Ascend more slowly.
        - If you experience severe or frequent reverse blocks, see a physician knowledgeable about dive medicine.

E Breathing Underwater

- ***How does depth affect how long your air supply lasts?***

1. Scuba gear supplies air at the surrounding water pressure.
    a. The deeper you dive, the greater the pressure, so the denser the air. This means there are more air molecules in each breath.
    b. As you go deeper, each breath takes more air from your scuba cylinder. Therefore, the deeper you are, the faster you use your air.
    c. This follows the air pressure/volume relationship.
        - Your air supply lasts ½ as long at 10 metres/33 feet (2 bar/ata) than as at the surface (1 bar/ata).
        - Your air supply lasts 1/3 as long at 20 metres/66 feet (3 bar/ata) than as at the surface (1 bar/ata), and so on.
        - Your breathing rate also affects how long your air supply lasts, of course.

- ***What's the most efficient way to breathe dense air underwater?***

2. Denser air is harder to inhale and exhale than air at normal surface pressure.
    a. Take slow, deep breaths when breathing dense air while diving. It takes four times the effort to breathe twice as fast.
    b. Pace yourself. To make your air last, save energy and don't over exert.
    c. Avoid getting winded or out-of-breath underwater.

- ***How do you breathe to reduce anxiety when under stress?***

3. Slow, deep breathing helps you handle stress and anxiety.
    a. When an emergency or a perceived threat causes anxiety, your body responds by increasing breathing.
    b. Controlling your breathing, however, can help control and manage anxiety so you deal with problems based on your training instead of emotionally.
    c. If faced with a problem while diving, stop what you're doing. Maintain or restore slow, deep breathing.

- ***What are your four breathing rules as a scuba diver?***

4. You have four breathing rules as a scuba diver.
    a. Breathe continuously and never, ever, hold your breath.
    b. Breathe slowly and deeply.
    c. Do not allow yourself to get winded or out-of-breath.
    d. If faced with a problem, stop, maintain/restore slow, deep breathing.

F. Buoyancy and Controlling Buoyancy

- ***What causes buoyancy?***
- ***What are positive buoyancy, negative buoyancy and neutral buoyancy?***
- ***Why does salt water cause more buoyancy than fresh water?***

1. Buoyancy is a force that pushes an object in water upward. This causes you to feel "lighter" in water.
    a. The force pushing upward is caused by the water displaced (pushed aside) by the object.
    b. The upward force is equal to the weight of the water displaced.
        - If an object weighs less than the water it displaces, it floats. This is called positive buoyancy.
        - If an object weighs more than the water it displaces, it sinks. This is called negative buoyancy.
        - If an object weighs the same as the water it displaces, it neither floats nor sinks, but is "weightless," somewhat like an astronaut in space. This is called neutral buoyancy.

c. Salt water has dissolved minerals (salt) in it, so a given volume weighs more than fresh water.
    - Because it weighs more, it causes more buoyancy – more upward force.
    - As a scuba diver, all else being the same, you have more buoyancy when diving in the ocean than when diving in a freshwater location such as a lake.

- ***What two pieces of equipment do you normally use to control buoyancy?***

2. You primarily use two pieces of equipment to control your buoyancy: your weight system and your BCD (Buoyancy Control Device).
    a. Your weight system holds lead weight.
        - You use just enough weight to offset positive buoyancy. It will have just enough weight to allow you to descend – it should not cause you to sink rapidly.
        - How much weight you need depends upon your gear, your physical characteristics and whether you're diving in fresh or salt water.
        - You will learn more about weight systems shortly, and learn how much weight to use, during your confined water dives.
    b. You inflate or deflate your BCD to increase or decrease your volume, which changes how much water you displace.
        - This adjusts your buoyancy so you can be positively, negatively or neutrally buoyant when you want.
        - This is one of the key dive skills you'll master, and you'll begin learning to use your BCD during your first confined water dive.
    c. Because they're central to your skill as a diver, most divers make their BCD and weight system two of their initial equipment investments.

- ***How do descending and ascending affect your buoyancy?***

3. Changing depth tends to change your buoyancy.
    a. Some pieces of scuba equipment – particularly wet suits – have gas spaces. These compress as the pressure increases and expand as pressure decreases, as you learned in the previous discussion.
    b. As you descend, compression of gas spaces causes their volume to decrease. This reduces the water displaced and you become more negatively buoyant. You offset this by adding air to your BCD (if diving with a dry suit, you may add air to the suit).
    c. As you ascend, the gas volume reexpands and buoyancy increases. The air you added to your BCD (or dry suit) also expands. You offset both and control your buoyancy by releasing the air you added as you ascend.

- ***How does breathing affect your buoyancy?***

4. Breathing also affects buoyancy.
    a. When you inhale, you increase your volume and displacement. This makes you slightly more buoyant.
    b. When you exhale, you decrease your volume and displacement. This makes you slightly less buoyant.
    c. With practice, you'll learn to use your breathing to fine-tune your buoyancy, but never hold your breath.

- ***Why is it important to master buoyancy control?***

5. As a diver, it is important to master buoyancy control because it affects almost everything you do in and underwater. Buoyancy control allows you to:
    a. descend and ascend at a slow, controlled rate.
    b. stop a descent or ascent and maintain your depth with little effort.
    c. float comfortably on the surface.
    d. save energy and avoid harming sensitive aquatic organisms by swimming neutrally buoyant and controlling your movement.
    e. maintain the underwater visibility by helping you not stir up the bottom.
    f. enjoy the dive – hovering and gliding effortlessly is one of the unique joys of diving.

G. Buddy System

- ***What is the buddy system?***

1. The buddy system is diving with another diver (or divers) in a team that provides mutual assistance and safety benefits. Recreational divers do not dive alone.
2. You and your buddy
    a. plan your dives together.
    b. help each other gear up and check each other's equipment.
    c. remind each other of dive time and depth limits.
    d. assist each other if there's a problem.
    e. assist each other with what you want to do on the dive.

- ***What are three overall benefits of the buddy system?***

3. The buddy system has three overall benefits.
    a. Practicality – you assist each other before, during and after the dive.
    b. Safety – you help each other prevent problems, and you assist each other if there is an emergency.
    c. Fun – diving is a social activity; it's rewarding and fun to have someone to share underwater adventures with.

III. Equipment 1

1. Without equipment, scuba diving does not exist.
   a. Therefore, learning about scuba gear and how to choose what's right for you is an essential part of becoming a diver.
   b. Different types and styles of equipment accommodate different types of diving, sizing, dive environments and personal preferences.
      - There are probably several brands/models of each piece that suit your needs as a diver.
      - As a new diver, the best way to select equipment suited to you is with the guidance of your PADI Instructor or PADI Dive Center or Resort operator.
   c. Like all technologies, dive gear continues to evolve and refine.
   d. In this course, you will learn the purpose for each piece of gear, as well as basic considerations related to fitting, selection, use and care.
   e. However, you should see your PADI retailer for more specific information related to individual brands and models.
   f. Because equipment evolves, stay up to date with the current options available.
      - The gear you invest in will usually last many years. But, you may trade up sooner because something new better accommodates what you want.
      - The easiest way to stay current is to stay connected to the dive community through your local PADI operator, the PADI Diving Society, ScubaEarth™ and other online dive communities, print and emedia dive magazines and publications, and connection with friends who dive.

A. Choosing and Caring for Scuba Equipment

- ***What are the three most important considerations in choosing scuba equipment?***

1. The three most important considerations in choosing any scuba gear are suitability, fit and comfort.
   a. Suitability means that the equipment is appropriate for you and the dive requirements.

      Example: A BCD with only basic features that fits is suitable whereas a BCD with many features, but that does not fit, isn't.

      Example: A short wet suit that fits you perfectly may be suitable for tropical diving, but would not be suitable for a dive in cold water.
   b. Fit means the equipment is sized and adjusted for you.
      - Many pieces of gear will not function, or function poorly, if they don't fit right.
      - See your PADI professional for assistance with sizing and fit as you select your equipment.

c. Comfort means you can wear the item for an hour or more without it becoming a significant distraction due to its feel or configuration.
    - Equipment that is uncomfortable is annoying and can take the fun out of a dive. It can sometimes distract your attention from safety issues.
    - Properly fitted equipment is almost always comfortable, but once in awhile there are exceptions because comfort is subjective. Be sure your gear fits and is comfortable.
    - Determining comfort is up to you. To a point, a professional can usually tell if something fits, but comfort is subjective. You have to say whether something is or isn't comfortable.

d. Your instructor or a professional at your local PADI dive operation can help you find suitable equipment that fits right and is comfortable.

- ***What are four secondary considerations when choosing scuba equipment?***

2. After being sure you address suitability, fit and comfort, there are four secondary considerations in choosing equipment:
    a. Cost and features – You can usually choose from a price range, with more features available on higher-end models. In most instances, you trade nonessential (but often desirable) features for price.
    b. Serviceability – Some equipment requires annual or biannual professional servicing. Access to that service may be a selection consideration. Most PADI Resorts and Dive Centers can provide service for the brands they sell.
    c. Color and style – You can usually choose gear that looks good as well as meeting the other requirements.
    d. Accessories – For each piece of equipment, your PADI professional can suggest related accessories. These are usually inexpensive, yet contribute significantly to using it and/or making it last. Don't neglect these.

- ***How do you generally care for scuba equipment?***

3. Different pieces of scuba gear have specific care requirements, but all items have the following steps in common:
    a. Inspect your equipment for proper operation, wear and damage before each use. Don't dive with anything that isn't in good working order.
        - You can take care of some issues, such as replacing a failing mask or fin strap.
        - Other issues, such as a problem with your scuba regulator, may require professional servicing.
    b. Rinse everything thoroughly in clean, fresh water after use in salt water, chlorinated water or fresh water with silt or dirt that you need

to rinse away. Allow it to dry out of the sun before storage in a cool, dry place.
    - This is important for keeping your gear reliable and allowing it to give you many years of service.
    - While divers are not a major cause of invasive species, thoroughly cleaning your gear also helps reduce accidentally transferring organisms from one environment to another. Check the web for regional information about reducing accidental organism transfer.
c. Avoid extended periods in direct sunlight. This tends to bleach out colors and speeds the deterioration of some materials. You often dive in bright sunlight, of course, but throwing a towel over your kit when possible helps protect it if you can't move it out of the sun.
d. Some items require periodic professional inspection, overhaul and/or adjustment. Have these items serviced regularly as required.
e. Follow any maintenance requirements specified by the manufacturer. See the manufacturer's literature and/or website.

B. Dive Masks

- ***Why do you need a mask?***
- ***Why does your mask need to enclose your nose?***

1. You need a mask so you can see underwater (obviously).
    a. Light behaves differently in water. Your eyes must be in air to focus properly.
    b. Because your mask is an air space, as you learned, you have to equalize it. This is why your mask must enclose your nose – so you can blow air into it.
    c. Never scuba dive with goggles. You can't equalize them, so you would get a squeeze.

- ***What features should you consider when choosing a mask? How do you check the fit?***

2. You need a good quality mask made specifically for scuba diving.
    a. To check for proper fit, with most, place the mask against your face gently and inhale through your nose. It should stay in place with suction without pushing or twisting to make it seal. Your PADI dive shop help you with the best ways to check the fit of different masks.
    b. Among masks that fit you, features to consider when choosing one include:
        - Low profile – A mask that sits as close to your face as possible (but still fits) gives you a wider vision field. It requires less air for clearing of water and equalizing.
        - Wide vision field – Beyond low profile, some masks have special shapes to accommodate more field of view. Some have side windows for peripheral vision.

- Silicone color – Some divers like the open "feel" of clear silicone rubber; others like the reduced glare of black.
- Frame color – You can usually match the rest of your kit with little difficulty.

[NOTE: Show students different scuba masks with varying features.]

- ***How do you prepare a new mask for diving?***

3. A new mask has some preparation steps.
   a. You may need to scrub the interior of the glass with a mask cleaner made for this purpose. This removes protective chemicals that some manufacturers apply. These chemicals increase a mask's tendency to fog. However, this is not true of all masks, so check manufacturer literature for specific cleaning recommendations.
   b. Adjust the strap for a proper fit.
      - Over the crown, above your ears.
      - Snug, but not overly tight.
      - Secure the strap-locking device if the mask has one.

C. Snorkels

- ***Why do you need a snorkel?***

1. Although scuba equipment supplies air, you also want a snorkel as standard equipment. While at the surface, a snorkel saves your air supply for the dive while you:
   a. Rest with your face in the water.
   b. Breathe when there's surface chop or splashing waves that would get into your mouth.
   c. Look underwater to adjust your gear or check out what is below.
   d. Swim with your face in the water, which is far less tiring than having to keep lifting your head to breathe.
   e. A snorkel is even more important for these purposes if you come up with little air remaining in your cylinder.

- ***What features should you consider when choosing a snorkel?***

2. As with your mask, get a snorkel that is specifically made for scuba divers so it has the features you need. You should be able to adjust it so that it fits comfortably in your mouth with the top at the crown of your head. Optional features and considerations include:
   a. Flexible lower portion – Allows the snorkel mouthpiece to drop out of the way when not in use.
   b. Self-drain valve – Makes it easier to blow water out of the snorkel when using it.
   c. Splash guard – Helps reduce amount of water than can splash in during use.

d. Color – You can match your other gear, though some divers like a bright color that's easy to see at the surface.

3. You usually invest in your mask and snorkel together. See your PADI Instructor, Dive Center or Resort for selection guidance.

[**NOTE:** Show students different snorkels with varying features.]

- ***How do you prepare your snorkel for diving?***

4. To prepare your snorkel
   a. Attach it to the left side of your mask (because your regulator is on the right), on the mask strap, using the clip, slot or keeper that comes with it.
   b. Adjust it so that with the mouthpiece in place, the tip is approximately over the crown of your head. This puts it at the highest point when you're face down in the water.

D. Fins

- ***Why do you need fins?***

1. You need fins to provide a large surface area for your powerful leg muscles to push against so you move efficiently through water. (People with limited leg mobility can use webbed gloves to make arm swimming more effective.)

- ***What are the two basic fin styles?***

2. There are two basic fin styles: adjustable strap and full-foot.
   a. Adjustable fins are open at the heel and have straps to hold them in place.
      - You usually wear wet suit boots with adjustable fins, which provide warmth and foot protection when walking.
   b. Full-foot fins enclose the heel and fit like snug shoes or slippers.
      - You usually wear full-foot fins with bare feet or thin fin socks, so they're for warm water use.
      - Full-foot fins have different blade sizes – some are suited to scuba, but others are best reserved for snorkeling.

- ***What features should you consider when choosing fins?***

3. Your primary considerations in choosing fins are fit and blade size.
   a. Fit adjustable fins wearing wet suit boots. It helps to wet your feet/fin socks when trying on full-foot fins.
   b. Fins should fit comfortably, yet not feel loose. Your PADI dive shop help you with proper fin fit.
   c. Blade size is usually proportional to the foot pocket size, but different models in your size may offer some choices.
      - The larger and stiffer the blade, the more strength you need.

- Very small, flexible blades take less muscle, but may be very inefficient.
- The "typical" size blade – what you find on most scuba fins that fit you – is usually the best all-round size. Fins intended exclusively for snorkeling may have blades that are smaller than optimal for scuba diving.

4. Optional features and considerations include:
   a. Material – Different materials give fins more or less performance, and make them heavier or lighter. Your instructor or dive center pro can help you with these differences.
   b. Split fins – Some divers prefer the kicking characteristics of fins that have splits down the blade center.
   c. Vents – Some fins let water pass through in key areas to assist performance.
   d. Quick release straps – Many adjustable fins have quick release buckles that make it easier to remove them when getting out of the water.
   e. Spring straps – For adjustable fins, once you get the right size, spring straps "auto adjust" for a proper fit and are highly unlikely to wear out.

[NOTE: Show students different scuba fins with varying features.]

5. Your PADI professional can help you choose fins appropriate for you.

- ***How do you prepare your fins for diving?***

6. To prepare your fins:
   a. Adjust the strap on adjustable fins for a comfortable fit with your wet suit boots on.
   b. Full-foot fins require little or no preparation other than washing them if they're slick with a residue left from manufacturing.

E. Scuba Kit

- ***What four equipment systems combine to make your scuba kit (scuba unit), and what is the purpose of each?***

1. Your assembled scuba kit (or scuba unit) is actually four equipment systems integrated into a single package. Each of these systems is made up of individual components, each with specific purpose. We'll look at these separately in a moment.
   a. BCD (Buoyancy Control Device) – Holds your kit together and allows you to adjust your buoyancy throughout the dive.
   b. Regulator – Delivers breathing air at the surrounding pressure when you inhale and routes your exhaled air into the water, which rises as bubbles.
   c. Cylinder – Holds the high-pressure breathing air supplied by your regulator during the dive.

d. Weight system – Holds lead weight to counteract the positive buoyancy of your body and some of your equipment, with a mechanism for dropping some or all the weight in an emergency.

[**NOTE:** Show students assembled scuba kit similar to what they'll be using, pointing out each of the systems. Reference this throughout the next sections about the systems and their subsystems.]

- ***What should you consider when choosing your scuba kit?***

2. You choose your scuba kit based on your size, personal preferences and the types of dive adventures that appeal to you.
   a. Because this equipment integrates, it is common to invest in the entire scuba kit as a package. Scuba equipment is generally interchangeable, but building your kit together helps assure that it meets your personal preferences.
   b. The following discussions on individual systems address some of the options for each, but the best way to put a system together is with professional guidance at your local PADI Resort or Dive Center.
   c. Most scuba kit components require regular professional servicing and inspection; be sure to consider this when choosing your gear. Most dive operators service the models and makes they sell.

F. BCD – Buoyancy Control Device

- ***What five components make up a BCD, and what does each do?***

1. The modern BCD has evolved from separate components that function best as a single unit. Its components include:
   a. Inflatable bladder – This is a very durable bag that you inflate or deflate to change your volume/buoyancy.
   b. Cylinder band and harness/jacket – The bladder integrates with an adjustable harness that holds the cylinder on your back. The bladder may be entirely behind you, or wrap partially around your waist and/or over your shoulders. With some systems, you can interchange harnesses and bladders to accommodate sizing and preferences.
   c. LPI (low pressure inflator) mechanism – Usually at the end of a large diameter hose, the LPI inflates the bladder with air from your cylinder, via the regulator, when you press a button. Another button allows you to deflate the bladder, or inflate it orally.
   d. Overpressure/quick exhaust valves – To prevent accidental overfilling from rupturing the bladder, BCDs have one or more overpressure valves that automatically vent if the BCD is too full. Some may have "quick dump" releases that let you activate them manually, which is sometimes easier (due to your position in the water) than using the LPI exhaust.
   e. Weight system – Many (but not all) popular BCDs have special weight pockets that you can release and drop in an emergency. The more weight you need (like when wearing a dry suit, which is very

buoyant), the more useful these are. (More about weight systems shortly).

f. There are some variations in BCD inflator, deflator and weight systems. Your instructor will show you the specifics for the BCD you use.

- ***What considerations and options do you have when choosing a BCD?***

2. Among BCDs that are the right size for fit and comfort, you can discuss the following options with your PADI professional when choosing one:
   a. Buoyancy capacity – Most BCDs cover a wide range of diving circumstances. Your BCD should have ample buoyancy to easily float you and all your equipment at the surface. You sometimes hear this called "lift" capacity.
   b. Pockets and D-rings – Many BCDs have pockets for storing and D-rings for attaching accessories.
   c. Shoulder quick release – A quick release buckle on one or both shoulders makes it easier to get out of your kit.
   d. Colors and style – You usually choose a look that matches the rest of your gear.

- ***How do you prepare your BCD for use?***

3. To prepare your BCD for use:
   a. Adjust it to fit snuggly, but not too tightly, while wearing your exposure suit. Your instructor will help you learn to do this.
   b. After adjusting, inflate the bladder fully to be sure it doesn't restrict your breathing. If it does, it's too tight.
   c. Attach a whistle to the LPI, where you can get it easily to signal for help if you have a problem at the surface.
   d. Attach hose clips and retainers that will hold some of your regulator components (more about these shortly).

- ***What two special maintenance considerations do BCDs have?***

4. Besides general maintenance steps, BCDs have two additional steps.
   a. The first is to rinse the inside of the bladder with fresh water as well as the outside. Fill it about 1/3rd with water, then the rest of the way with air. Slosh the water around, then drain it through the LPI exhaust and through each of the quick dumps (if you can manually activate them). You may need to reinflate it with air a couple times to get out all the water.
   b. The second consideration is that you store most BCDs partially inflated so the bladder doesn't stick together inside.

G. Regulators

- ***What five components make up a regulator, and what does each do?***

1. When you select "a regulator" at your local PADI Dive Center, you are choosing the first and second stage. You select the other components individually. These five components make up your regulator as you will dive with it:
   a. First stage – This simple, reliable device connects to the cylinder valve. It either screws into the valve or is held in place by a yoke (clamp system). An o-ring seals the first stage and valve in either case. The first stage reduces cylinder pressure to an intermediate pressure (7-10 bar/100-150 psi above the surrounding pressure). It supplies air to all the other regulator components.
   b. Second stage – This is the component you breathe from. Also a simple, reliable valve, it reduces the first stage intermediate pressure to the pressure around you.
      - It delivers air only when you inhale – on demand – and has one-way valves that vent your exhalation into the water.
      - The purge button on the second stage lets you manually release air.
   c. Alternate air source (AAS) – This is an extra second stage you use for sharing air with a buddy should the need arise.
      - The most popular alternate air source is a standard second stage on a longer hose (alternate second stage). It may be brightly colored. If needed, you pass it to your buddy to share air.
      - Some divers prefer an alternate inflator regulator. An alternate inflator regulator combines a second stage with your BCD low pressure inflator. If needed, you switch to it and pass your buddy the primary second stage from your mouth. This is a part of your BCD when your kit is disassembled.
   d. Pony bottles and self-contained ascent bottles are small cylinders with their own regulators.
      - These provide an alternate air source that is completely separate from your main scuba kit. This means you can use it as well as share air with it.
      - A self-contained ascent bottle has just enough air to reach the surface and usually attaches to your BCD harness.
      - Pony bottles hold more air than self-contained ascent bottles, but they're bigger. You typically strap them to your main cylinder or clip them to BCD D-rings.
      - Most divers who have pony/self-contained ascent bottles also have a standard alternate second stage.
   e. Low-pressure inflator (LPI) hose – This is a hose that connects to your BCD inflator. When diving with a dry suit, you have two. The

second hose allows you to add air to the suit as you descend (more about this later).

f. SPG (Submersible Pressure Gauge) – This gauge tells you the remaining air pressure in your cylinder. This allows you to manage your air supply.
   - The simplest SPG is a hose with a mechanical gauge that reads bar (metric) or psi (imperial, pounds per square inch).
   - The SPG may have other instruments attached in a console – more about these other dive instruments in Knowledge Development Two.
   - The SPG may be built into your dive computer, or they may be two separate instruments. If it is integrated into your dive computer, it still tells you how much air you have (you'll learn more about dive computers in the next knowledge development).

- ***What is the most important consideration in choosing a regulator? What considerations and options do you have when choosing a regulator?***

2. You have a lot of considerations when choosing a regulator and its subcomponents. However, the most important consideration in choosing a regulator is ease of breathing.
   a. All modern regulators from reputable manufacturers meet the breathing requirements for diving within normal recreational limits.
   b. Higher end models usually have the best performance and breathe the easiest.
3. Considerations and options for the first and/or second stage include:
   a. Yoke or DIN – The yoke system holds the first stage to the cylinder with a clamp system called a yoke. In the DIN system, the regulator threads into the valve.
      - The yoke system is older and widely established.
      - The DIN system is used extensively in Europe and is rated for higher pressures.
      - DIN seems to be growing and gradually replacing yoke.
      - Your instructor or PADI Dive Center can advise you as to which system is most popular where you intend to dive. If unsure, a common option is to invest in a DIN regulator with a yoke adapter. This allows you to use it on either valve type.
   b. Adjustable second stage – This is a knob that allows minor air flow adjustments. It lets you keep the regulator breathing its best over the course of its maintenance cycle.
   c. Dive/Predive switch – Top performing regulators easily freeflow (release air without control) when out of your mouth in the water. This switch reduces freeflow when the second stage isn't in your mouth.

d. Cold water first stage – In cooler climates, the first stage can freeze, resulting in a freeflow. Special cold water first stages reduce the likelihood of this by surrounding the stage with a special liquid.

- ***What are your considerations and options when choosing an alternate air source?***

4. Considerations and options for choosing your alternate air source include:
   a. Simplicity – The extra second stage and the alternate inflator regulator are the simplest types to transport, set up and care for.
      - No separate setup and maintenance – they are part of your regulator and/or BCD.
      - These have the least weight and bulk.
      - They must be compatible with your first stage – this is not usually an issue with modern regulators, but your PADI Professional can confirm compatibility.
      - You usually select these at the same time you get your regulator.
   b. Independence – Some divers opt for a pony or self-contained ascent bottle to handle an air supply problem without buddy assistance (but this doesn't replace diving with a buddy).
      - To get this independence, you have more gear to transport and some additional care requirements.
   c. The extra second stage and alternate inflator regulator seem to address the alternate air sources needs of most recreational divers, and are the most popular.

- ***What are your considerations and options when choosing an SPG?***

5. The considerations and options for choosing your SPG are usually driven by your choice of dive computer:
   a. If you choose a nonintegrated computer (your SPG is not integrated into your dive computer), you will probably choose a standard mechanical SPG.
      - The SPG is at the end of a hose from your regulator and secures to your BCD (usually on the left side).
      - Although not integrated, your computer may mount in an instrument console attached to the SPG.

   b. If your SPG is integrated with your dive computer:
      - The computer may connect to a hose from the first stage to receive air pressure information. These computer/SPGs are commonly part of consoles with other instruments.
      - The computer may be hoseless. A transmitter on the first stage sends pressure information wirelessly to your computer on your wrist.

c. The next Knowledge Development Section goes into detail about what your dive computer does and some of your options in choosing one.

- ***How do you prepare your regulator for use?***

6. Preparing a new regulator requires attaching all the components to the appropriate ports (hose connections), which should be done by a scuba professional.

- ***Where do you place or secure each regulator component when diving? Why is this important?***

7. In setting up your scuba kit (discussed shortly), you place or secure regulator components appropriately for use during the dive. Generally:
   a. The first stage mounts on the cylinder facing inward (toward your head)
      - The second stage goes over your right shoulder and the SPG hose is on the left.
      - This is important because you can't locate the other components properly if you don't orient the first stage correctly.
   b. The second stage you breathe from is not usually secured.
   c. Regardless of the type, secure your AAS second stage where it is visible in the triangle formed by your chin and the lower corners of your rib cage.
      - An extra second stage secures with a quick release device. It usually has a bright color or other marking. It commonly comes under your right arm, though a few divers prefer to mount it on the left.
      - An alternate inflator regulator normally stays in place on your BCD.
      - The placement, marking and securing are important so your buddy can locate it quickly in an emergency.
      - It is important that you don't allow your AAS to dangle. Doing so can damage it. It can fill with mud or sand so it isn't usable in an emergency, and it may damage sensitive organisms. Also, dangling causes drag that wastes energy and air.
   d. The low pressure hose for your BCD routes over your left shoulder and connects to the inflator. Retainers on the BCD hold it in place. A hose for your dry suit may route under either arm, depending upon your dry suit and preferences.
   e. An SPG with a hose (integrated or non integrated) routes under your left arm and secures with a clip or hose retainer to the front of your BCD.
      - You should be able to read it or easily secure it so you can do so.
      - It is important to never let your SPG dangle; doing so can

damage it and sensitive aquatic life. It also creates drag that wastes your air and energy.

- Some divers route the SPG hose under their left arms and through the BCD jacket opening so it comes out in the center of the chest. This keeps it from dangling even if you've lost or forgotten a hose retainer or clip.

- ***What three special maintenance considerations do regulators have?***

8. There are three special considerations related to taking care of your regulator and its components.
   a. Rinse your regulator with a gentle fresh water flow with the first stage dust cap tightly in place, or the first stage still attached to a cylinder. Don't allow water to enter the air inlet where it meets the cylinder valve.
   b. Run water through the second stages while rinsing, but do not press the purge button. This could allow water to flow up the hose to the first stage.
   c. Regulators require periodic overhauls by a professional.
      - Most models require overhauls every year to two years. Have this done as required by the manufacturer, even if it seems to be working fine.
      - Do not use a regulator if it has high breathing resistance, leaks water, appears damaged in any way or seems not to function properly in any way. Have a professional inspect and service it.

H. Cylinders

- ***What two components make up a scuba cylinder? What does the burst disk do?***

1. Your scuba cylinder (tank) consists of two components – the cylinder itself, and the valve.
   a. The cylinder is an aluminum or steel alloy vessel made specifically for storing high pressure air.
   b. The valve, made of chrome-plated brass, enables or disables air flow to and from the cylinder.
      - In many, but not all, countries, the valve has a burst disk.
      - The burst disk is a safety device that relieves accidental overpressure by rupturing and releasing the air well before the pressure at which the cylinder would fail.

- ***What considerations and options do you have when choosing cylinders and valves?***

2. You have several options in choosing cylinders and valves, though in most areas one or two types tend to be the most popular.
   a. Material – both steel and aluminum make excellent scuba cylinders.
      - Aluminum resists corrosion in wet climates.

- Steel cylinders usually hold the same amount of air with a smaller size and/or lower pressure.

b. Size and capacity – Different size cylinders have different capacities.
   - In the metric system, you refer to cylinders by their internal (liquid) capacity. Common sizes are 8, 10, 12 and 15 litres.
   - In the imperial systems, you refer to cylinders by the cubic feet of air it holds when full, if you released the air at the surface. Common sizes are 50, 63, 71.2 (a.k.a 72) and 80 cubic feet.
   - How much your cylinder holds depends upon both its internal capacity and its rated working (maximum) pressure. A cylinder can have a higher working pressure than another, but hold less air because the internal capacity is low.
   - Your PADI Resort or Dive Center can help you choose an appropriate cylinder.

c. Yoke or DIN – You learned about yoke/DIN in the regulator discussion. You choose your valve and regulator to match.
   - If in doubt about what type regulator you may need to use on a cylinder, a good option is a DIN valve that accepts a yoke insert. This lets it take either type.

d. Reserve or nonreserve valve
   - Before the invention of the SPG, valves with reserve mechanisms were standard. Today, they're the exception.
   - A few regions still use reserve valves to meet legal regulations.
   - A reserve valve (often called a "J" valve) is a warning device; it does not give you any more air than if you were using a nonreserve valve. To alert a diver of low air, these valves have a spring mechanism that shuts off the air when about 20-40 bar/300-500 psi remains. You release the remaining air by pulling down a lever.
   - Even in regions that use reserve valves, you primarily manage your air supply with your SPG.

- ***What do the markings on a cylinder tell you?***

3. A scuba cylinder will have several markings. Some of these are stamped into the metal; others are labels stuck on the side.
   a. The following are typically stamped into the metal (varies internationally):
      - Cylinder alloy – typically a code number
      - Serial number – record in case your cylinder is lost or stolen.
      - Working pressure – the maximum allowed fill pressure
      - Manufacturer's identification
      - Manufacture date

- Test pressure – the pressure used for periodic hydrostatic tests (more about these shortly)
- Hydrostatic test date – there will be a least one, but there will be additional dates for each test over time
- Other markings required by local laws or regulations
- Of these markings, you are primarily interested in the serial number, working pressure and the hydrostatic test date.

b. The following are labels found on cylinders.
- Visual inspection decal – shows the date of the annual visual inspection (more about these shortly).
- Enriched Air Nitrox (EANx) or Nitrox band around the crown – indicates the cylinder has enriched air nitrox. This is air with additional oxygen added to it. You need certification as a PADI Enriched Air Diver to use enriched air. Don't use a cylinder marked this way until certified as a PADI Enriched Air Diver, or under the supervision of a PADI Instructor who is an Enriched Air Instructor.
- Oxygen clean/Not Oxygen Clean decal – found on enriched air cylinders, tells PADI dive operators information for filling the cylinder with EANx.

- ***What three safety precautions for handling scuba cylinders should you follow?***

4. Cylinders are heavy, so there are three handling precautions to follow.
   a. Don't leave a cylinder standing unattended when in use, particularly once you assemble your scuba kit. A falling cylinder can damage equipment and injure people if it falls on someone's foot. Lay it down with the BCD up.
   b. Secure cylinders for transportation. Block or otherwise restrain them securely so they can't roll or slide.
   c. Keep cylinders secured on boats. Cylinders will tumble from their racks when the boat rocks, posing an injury risk, as well as a damage risk to gear and the boat. Have the restraining cord in place, even if you need to step away only momentarily.

- ***What six special maintenance considerations do cylinders have?***

5. Cylinders are highly reliable and typically last decades if properly cared for, but they have six special maintenance requirements.
   a. Hydrostatic tests – Laws and regulations require that scuba cylinder receive periodic pressure tests called hydrostatic tests every two to five years (varies regionally). Have your cylinder tested as required; never have a cylinder filled that has not been tested within the required interval. Your PADI dive operation can arrange for hydrostatic tests.
   b. Visual inspection – Scuba cylinders are drained, opened and inspected internally for corrosion or other contamination/damage.

Never have a cylinder filled that doesn't have a current visual inspection decal. Your PADI Dive Center can do conduct the inspection for you.

c. Close and open the valve gently – You don't need to use excessive force when opening and closing the valve. Doing so may damage it.

d. Keep some air in it – To avoid moisture entering the cylinder, never let it get completely empty. Keep 20 bar/300 psi or so in it. (If you accidentally drain it completely, have your PADI Dive Center or Resort visually inspect it). Note that draining the air quickly can cause condensation even if you don't drain it completely.

e. Store the cylinder standing – Before and after diving lay it down, but for storage, stand it in a safe place where it won't get knocked over. This is so if moisture does get in, it will accumulate on the bottom, which is the thickest part.

f. Keep your cylinder out of high heat.
   - Increased temperature raises the pressure and could blow the burst disk.
   - Very high heat (like being in a fire) can damage the alloy. If a cylinder has been in a fire, it needs professional testing before reuse (aluminum cylinders are usually condemned).
   - If you want to paint your cylinder, see your PADI professional for guidance. Some metal painting processes use heat (like automotive painting) and will damage the alloy, making the cylinder unsafe even though it looks unaffected.

- ***Where do you get scuba cylinders filled? Why?***

6. Get your cylinder filled only at a reputable scuba air station, such as a PADI Dive Center or Resort.

   a. Scuba air must be must specially filtered, and filled by compressors designed specifically for breathing air.
      - Contaminants in air that may be harmless at the surface can be toxic at depth.
      - Reputable scuba air stations meet standards for air purity.

   b. Have your cylinder filled only with air.
      - Under pressure, oxygen can become toxic. This is why you need special training to use enriched air nitrox.
      - Some forms of diving use pure oxygen. These types of diving require additional training and certification.
      - With your certification level diving with anything other than air from a reputable scuba air source in your cylinder can be hazardous, with risks that include death or permanent injury.
      - As a PADI Open Water Diver, you can get certified to use Enriched Air Nitrox (EANx – Enriched Air for short), which is air with a higher proportion of oxygen. Using Enriched Air lets you stay underwater longer in many circumstances.

I. Weight Systems

- ***What is the most important feature in your weight system?***
- ***In an emergency, is it necessary to drop all your weight?***

1. The most important feature in your weight system is a quick release that enables you, in an emergency, to drop enough weight to assure positive buoyancy so you float even without air in your BCD.
    a. The ability to do this is an important safety consideration, but you do not have to be able to drop all your weight.
        - Most BCD weight systems have two quick releases so you can drop your weight in two portions.
        - Some BCDs have nonreleaseable weight pockets. You use these for trim, but you should have enough releaseable weight to assure positive buoyancy. (More about trim shortly.)
    b. You only have to be able to drop enough weight so that with an empty BCD, you would float reliably.
    c. When wearing a full wet suit or dry suit, dropping only part of your weight will accomplish this.
    d. Wearing no exposure suit or a partial wet suit, you don't need much weight, so you should be able to drop all, or nearly all, your weight.

- ***What is trim? Why is it important?***
- ***Why might you use more than one weight system?***

2. You'll practice proper weighting during your training dives. Proper weighting has two aspects.
    a. The first is the right amount of weight – you want to wear just enough to offset your positive buoyancy, but not more.
    b. The second is the right distribution of weight. This is called trim.
        - Trim is your orientation and balance in the water – generally, the desired trim is a natural horizontal swimming position with your feet parallel to the bottom or slightly elevated.
        - Your BCD and weight placement determine trim.
        - Trim is important because it helps you maintain the optimum body position in the water. This saves energy, helps reduce accidental damage to fragile organisms and makes diving more enjoyable.
3. Some divers use more than one weight system.
    a. This allows you to distribute your weight for optimal trim.
    b. When wearing buoyant exposure suits (like a dry suit), it may be easier to handle two or three weight systems rather than one relatively heavy one.
    c. You distribute weight so with at least one system, you can quickly release enough weight to assure positive buoyancy with an empty BCD.

- ***What are your considerations and options when choosing one or more weight systems?***

4. You can choose from different weight systems depending upon your preferences, weight required and trim requirements. Your instructor or dive center can help you determine this.
    a. BCD weight integrated systems
        - Simplify putting your gear on
        - Eliminate another piece of equipment
        - Comfortable
        - Commonly have special pockets to assist with trim
    b. Weight belts
        - Oldest weight system
        - An option when you don't need much weight
        - Sometimes used to redistribute weight (third system) with weight integrated BCD when you need a lot of weight
    c. Accessory weights
        - Used to adjust trim
        - Special versions clip to ankles (to correct feet too high) or cylinder valve (to correct feet too low)
        - Should be only a small portion of total weight so quick release isn't an issue

IV. Your Skills as a Diver 1

[NOTE: Explain whether student equipment will be set up for the first confined water dive, or whether students will set it up with instructor guidance and help. Demonstrate setup with a scuba unit. Briefly review the skills student divers will learn during the first confined water dive.]

A. Setting up your scuba kit

B. Gearing up with your buddy

C. Inflating and deflating your BCD - low pressure inflator and oral

D. Breathing underwater

E. Hand signals

[NOTE: Demonstrate each signal]

1. Okay? or Okay
2. Stop
3. Go up; end the dive now
4. Something's wrong
5. Which way?
6. Boat
7. Ears not clearing
8. Come here
9. Watch me
10. Get with your buddy
11. Hold hands
12. You lead, I'll follow
13. Down; descend
14. Low on air
15. Out of air
16. Share air
17. Slow down, calm down
18. Breathe
19. How much air do you have?
20. Danger – hazard
21. Turn the dive – head back
22. I'm cold

F. **Regulator clearing**

G. **Regulator recovery**

H. **Clearing water out of your mask**

I. **Managing your air supply**

J. **Descending and equalizing**

K. **Swimming Underwater**

L. **Alternate air source use**

M. **Ascents and returning to the surface**

N. **Emergency weight drop**

O. **BCD oral inflation at the surface**

P. **Exiting the water**

Q **After the dive.**

Summary

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II. Being a Diver 1

III. Equipment 1

IV. Your Skills as a Diver 1

Knowledge Development Two

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C. Staying Warm

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A. Exposure Suits

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D. Dive Instruments

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F. BCD – Buoyancy Control Device

G. Regulators

H. Cylinders

I. Weight Systems

III. Your Skills as a Diver 2

Outline

I. Being a Diver 2

A. Seeing and Hearing as a Diver

- ***How does being underwater affect the apparent size or distance of things?***

1. Water is about 800 times denser than air. This makes light change direction slightly (refract) when it transfers from water into the air in your mask.
   a. This magnifies everything you see underwater by about a third.
   b. Depending upon your perspective at the time, this makes everything look larger, closer, or both.
   c. As a new diver, you may reach for something and miss because of this. With experience, you learn to compensate unconsciously.

- ***How does water affect light intensity and color?***

2. Water reflects, scatters and absorbs light.
   a. This means you have less light underwater. The deeper you go, the darker it is.
      - Your eyes are very sensitive to light. During the day, at most popular dive sites you usually have adequate light even at the dive's deepest depth.
      - Light transmits through the very clearest water to depths well beyond what divers can reach.
      - For diving at night or in conditions that make it dark at depth, you can use a dive light. You can learn about this in the Night Adventure Dive when you take the PADI Advanced Open Water Diver course.
   b. Water directly absorbs light, but not uniformly. It absorbs some colors before others as light travels through it. The further it travels, the more color lost.
      - You will notice that as you go deeper, red is the first color absorbed, followed by orange, yellow, green and finally blue.
      - You see the same color loss when looking at distant objects. Objects further away have less color and become more colorful as you get closer.
      - Your eyes adjust somewhat for the color change, so you may not notice unless you shine a light on something at depth, revealing the lost color.

- ***How does hearing differ underwater?***

3. Water transmits sounds more efficiently than does air.
   a. You will hear many new sounds from aquatic organisms, boats, divers and other sources.

b. Sound travels over longer distances. For example, a boat that you can't hear at the surface may sound relatively close underwater.
c. Sound travels about four times faster in water than in air.
   - This makes it difficult to determine its direction.
   - Underwater, it usually seems like sound is coming from all around, or to some people, directly overhead.
   - You may be able to tell relative changes in distance by whether a sound gets louder or fainter, even though you can't tell the direction.

B. Swimming and Moving

- ***How does water's density affect moving in water?***
- ***How do you move efficiently as a diver?***

1. Because water is so much denser than air, it takes a lot more effort to move through.
   a. It takes four times as much energy to double your speed. The faster you try to swim or move, the more energy you use and the faster you tire. This also causes you to use up your air faster.
   b. You don't need to rush while diving. To move efficiently as a diver, move slowly and steadily. Avoid rapid and/or jerky moves, which waste your strength.

- ***How does streamlining benefit you as a diver?***

2. Streamlining benefits you by reducing the energy you use underwater. This makes the dive more relaxing and helps you save air for a longer dive.
   a. Streamlining is the process of wearing your gear close, with nothing dangling, and swimming relatively level in the water. This reduces drag.

- ***Why is trim important to streamlining, moving efficiently and protecting the underwater environment?***
- ***What skill allows you to use water's density to make moving in water more efficient?***

3. You learned in Knowledge Development One that trim is your balance in the water – whether, when neutrally buoyant, you tend to hover feet up or down. With ideal trim, you float with your feet and head relatively level.
   a. Trim depends upon having both the correct amount of weight and correct weight placement.
      - If you have more weight than you need, you compensate by inflating your BCD. This raises your torso and lowers your feet. Too little weight tends to do the opposite.

- You can have the correct amount of weight, but it may be distributed too high or low on your body for proper trim.
- During your training dives, your instructor will help you with correct weighting and placement for good trim.

4. When you have correct trim, you use the skill of controlling your buoyancy to make water's density work for you so you move efficiently.
   a. The ability to change your buoyancy is what makes diving a unique, fun experience.
   b. As you dive, stay neutrally buoyant – almost weightless – so you glide smoothly through the underwater world.
   c. At the surface, inflate your BCD so you float effortlessly.

C. Staying Warm

- ***Why do you chill faster in water than in air at the same temperature?***

1. Water absorbs more heat than air of the same temperature does, and absorbs it about 20 times faster.
   a. Because of this, you can chill rapidly in water that feels warm when you first get in.
   b. Even water that is 30ºC/86ºF will chill you after awhile (though you may find you stay comfortable long enough to enjoy a dive in water this warm).

- ***What do you do to stay comfortably warm while diving?***
- ***What should you do if you're not warm enough while diving?***

2. To stay comfortably warm while diving, you choose an appropriate exposure suit – a wet suit or dry suit – to insulate you.
   a. An exposure suit is generally required for diving in water 24ºC/75ºF or cooler.
   b. Even in tropical water that is warmer than 24ºC/75ºF most divers still use an exposure suit.
   c. You choose your suit based on the water temperature and how long you plan to dive.
      - Dry suits provide the most insulation. You use these for the coolest water/longest dives.
      - Wet suits allow diving in a wide temperature range because you can choose different thicknesses, and select different styles that cover more or less of your body.
      - More about exposure suits later in this section.
   d. If you are not warm enough while diving, end the dive.
      - Diving is for fun; it makes no sense to keep diving if it isn't fun. You don't have to get cold while diving, even in relatively cool water.

- After such a dive, select an exposure suit that provides more insulation for the next time.

- ***What should you do if you start shivering uncontrollably?***

3. Exposure suits work very well, but in all but the warmest water, you still lose heat, very slowly.
   a. If you are in the water long enough, you will eventually get cold.
   b. Normally, you'll end the dive if you start to get too cool for comfort. However, be aware that uncontrollable shivering is a sign/symptom of hypothermia.
   c. Hypothermia is a serious condition in which your body cools so much it can no longer function properly. If you begin to shiver continuously, exit the water immediately, dry off and seek warmth.

D. Breathing Effectively Underwater

- ***What is the most effective way to breathe while diving? Why is it important?***

1. When scuba diving, the most effective way to breathe is to breathe slowly and deeply. This is important for several reasons:
   a. As you learned in Knowledge Development One, the air you breathe while underwater is denser than at the surface.
      - Denser air requires more effort to breathe.
      - The denser the air and the faster you breathe, the more energy you use breathing.
   b. When you breathe, your body absorbs oxygen it needs and releases waste carbon dioxide.
      - This gas exchange only happens in the lungs – the air in your breathing passages does not take part in gas exchange. These air passages are called dead air space. The first air you inhale with each breath is the air from your last exhalation, and is higher in carbon dioxide.
      - Dive equipment adds dead air space. If you breathe shallowly and rapidly, you rebreathe a much greater proportion of dead air with each breath. Breathing slowly and deeply reduces the proportion of dead air in each breath.
   c. Breathing slowly and deeply is how you breathe when you're relaxed. Making a point of breathing slowly and deeply helps you stay relaxed, and it can help you calm down if you begin to feel anxious. Effective gas exchange from proper breathing helps you stay clear-headed and make better decisions.

- ***What is "airway control"? What are two techniques for it?***

2. Airway control is the skill of breathing past small amounts of water in your regulator or snorkel. It is common to have some residual water in your regulator or snorkel, especially after clearing it, but you can breathe without drawing any water into your throat.

a. After clearing your regulator or snorkel, assume it will have a little water left and use one or both of two airway control techniques.
b. The first technique is to inhale slowly. Because water weighs more than air, if you inhale slowly, water tends to stay in the mouthpiece while the air enters your mouth and lungs. It helps to look downward a bit.
c. The second technique is to raise your tongue against the roof of your mouth as you inhale. Your tongue will tend deflect water as air flows around it. Again, looking downward a bit helps.
d. You can combine both methods.
e. If you get a few drops of water in the back of your throat, you may feel the urge to cough. This is not a problem. You can cough into a regulator or snorkel – simply hold it in place as you do.

- ***What are eight symptoms of overexertion while diving?***
- ***What causes overexertion while diving? How do you prevent it?***
- ***What should you do if you think you're becoming overexerted at the surface and underwater?***

3. Overexertion while diving can be alarming, and has been known to lead to panic and accidents. You can avoid and/or stop overexertion by recognizing its symptoms, causes and learning how to prevent it. You should also know how to respond properly if you experience it.
   a. Overexertion symptoms include:
      - fatigue
      - labored breathing
      - a feeling of suffocation or air starvation
      - weakness
      - anxiety
      - headache
      - muscle cramping
      - a tendency to panic
   b. Overexertion usually results from prolonged elevated effort, like fighting a current. It is caused by trying to breathe dense air rapidly, faster than equipment can deliver it.
   c. To prevent overexertion, breathe slowly, deeply and continuously. Avoid lengthy, strenuous exertion while diving. If your breathing rate begins to rise, stop and rest before it becomes labored.
   d. If you experience overexertion, stop all activity, signal your buddy and rest. Further activity makes it worse.
      - At the surface, inflate your BCD and/or drop your weights so you don't have to fight to stay at the surface. Signal the boat to pick you up, if appropriate.

- Underwater, hang onto an object or rest on insensitive bottom.
- After restoring normal breathing, resume activity at a lower pace, avoiding the effort that caused the problem.

4. Remember that when scuba diving, your breathing goal is to always breathe slowly, deeply and continuously.

E. Buddy System (continued)

- ***How do you and your buddy plan dives together? What nine points should a dive plan normally include?***

1. You've learned that as a diver, you will plan and make your dives with your buddy or buddies.
   a. Plans don't have to be complex or lengthy, but they help you avoid problems and plan your fun.
   b. You plan your dives together by discussing what you want to accomplish, the best techniques, hazards to avoid and what to do if problems occur.
   c. There may be more, but your dive plan usually addresses these nine points:
      - Agree on the best entry and exit techniques for the environment.
      - Decide what course you'll follow underwater.
      - Agree on the maximum time and depth for the dive.
      - Review underwater signals and other communications.
      - Determine when you will turn around and head back based on your remaining air, time and/or other factor – (you will turn the dive on all of these – whichever comes first).
      - Agree on how you'll stay together during the dive (e.g., swim side-by-side, one leads while the others follow, etc.).
      - Establish what you will do if you become separated from a buddy.
      - Discuss emergency procedures.
   - Agree on an objective. An objective may be detailed, such as "shoot videos of butterfly fish pairs," or as simple as, "let's go for a look."

- ***How do you and your buddy kit up together?***
- ***How and when do you conduct the predive safety check?***

2. You may have already practiced kitting up together during Confined Water Dive One.
   a. You and your buddy gear up at the same time so you're both ready to get in the water together.
   b. You may assist each other with zipping exposure suits, adjustments, holding scuba kits for each other, etc. The amount of assistance you give each other depends on the circumstances.

c. You and your buddy conduct the predive safety check after kitting up (except for mask, snorkel and fins in many instances), but before entering the water. You conduct the check so you're familiar with each other's gear, and you make sure it is ready to go.

d. Remember Begin With Review And Friend, or any other phrase that helps you recall BWRAF.
   - Begin – B – BCD: Check adjustment, operation, low pressure inflator connection, and that the cylinder is firmly in the band. If appropriate for the entry technique, make sure it's partially inflated. Confirm that your visual and audible surface signaling devices, which are usually attached to your BCD or in a BCD pocket, are in place. (You'll learn more about surface signaling devices later.)
   - With – W – Weight: Check that you have the right amount of weight, that it's distributed for proper trim, and that the quick release is clear so that you can, in a single motion, release enough weight to be sure you float.
   - Review – R – Releases: Confirm everyone's releases are secure, and that all buddies know how to work each other's releases in case they need to do so in an emergency.
   - And – A – Air: Test breathe your regulator two or three breaths. Check your air pressure to be sure it shows a full cylinder. All buddies make sure they know how to access each other's alternate air sources so they can share air should they need to do so.
   - Friend – F – Final Check: Look each other over for anything that seems to be missing, out of place, not adjusted correctly, etc.

e. Perform the predive safety check before every dive. With practice, it takes only a few moments, yet it prevents inconveniences, disappointments and accidents.

- ***What do you do if you get separated from your buddy during a dive?***

3. During the dive, you and your buddy need to stay close together – ideally within a couple metres/few feet.
   a. If you find yourself farther apart than that, get back together. A good rule of thumb is to be able to reach your buddy in two seconds.
   b. It's easier to stay together if you discuss how you will do so during dive planning.
   c. Buddy separation occurs when buddies can't see each other.
      - Remember that in clear water, you may be able to see each other, but still be too far from each other.
      - In lower visibility, it is easier to lose sight of each other if, for example, your buddy stops to look at something while you keep swimming.

- In either circumstance, staying close and checking each other frequently reduces accidental separation and/or being too far apart.

d. Discuss what you should do if you get separated – how you will reunite (meet some place, etc.) during dive planning.

e. The general procedure is to look for each other for no more than a minute, then if unable to relocate each other, carefully ascend and reunite on the surface.

f. This procedure may not be practical in some environments, so it's important to plan what you would do if buddy separation occurs in those instances.

g. When three people dive together, if one gets separated, all divers enact the procedures for reuniting. Even though two divers are still together, they must take action to rejoin the isolated buddy.

- ***Whose responsibility is the buddy system?***

4. The buddy system works well when divers plan their dives together, conduct the predive safety check together, stay together and manage their air together. Remember: It's your responsibility to stay with your buddy and follow the rules, guidelines and recommendations for each other's dive safety. No one can do it for you.
5. The PADI Skill Practice and Dive Planning Slate provides a handy check list for basic dive planning steps. Use it during the course to develop your ability to plan dives, and after the course as a checklist during planning.

F. Managing Your Air Supply as a Buddy Team

- ***How do you and your buddy manage your air supply together while diving?***

1. You manage your air supply while diving, but you interact with your buddies as you do so.
2. People use air at different rates. Someone will always use air the fastest, and someone the slowest.
3. Throughout the dive, you and your buddy let each other know how much air you have. You turn the dive and head back based on the diver who's using it the fastest.
4. On many shallower dives in which air supply is the limiting factor (you'll learn some other limits in Knowledge Development Four), you can plan your air use something like this:
   a. Suppose you and your buddies are diving from a boat and have the same size cylinders. You all start the dive with 200 bar/3000 psi.
   b. You agree that 50 bar/500 psi is ample reserve pressure.
   c. That leaves 150 bar/2500 psi for the dive (200 bar – 50 bar = 150 bar, or 3000 psi – 500 psi = 2500 psi).

d. You want to save 20 bar/300 psi for the ascent and safety stop. To do this, add 20 bar/300 psi to your reserve. This means you want to start up the mooring line when or before you reach 70 bar/800 psi. So, you have 130 bar/2200 psi for the main part of the dive.

e. During the dive, together you follow the reef outward until someone has used half of the 130 bar/2200. This means you head outward until someone has used 65 bar/1100 psi (half the usable supply). You're starting with 200 bar/3000 psi, so when someone reaches 135 bar/1900 psi (200 bar – 65 = 135 bar, or 3000 psi – 1100 psi = 1900 psi), it's time to head back. This is called your turn pressure.

f. You reverse course and use another 65 bar/1100 psi swimming back to the mooring line. When you get there, you should have at least 70 bar/800 psi for your ascent, safety stop and reserve. When you surface, you should have at least 50 bar/500 psi – your reserve – remaining.

g. You will commonly use a bit less air than planned coming back, but often you can delay your ascent to enjoy your "extra" air.

- For example, if you reach the mooring line and all divers have more air remaining than planned, you can explore in the immediate area until you have to head up.
- This commonly happens with appropriate, conservative diving planning and habits.
- With conservative planning and habits, if something unexpectedly delays your return, or causes you to use more air than normal, you will still likely reach your ascent area within your planned air supply.
- If the unexpected causes you to reach your planned ascent pressure before you reach your planned ascent point, surface where you are and swim the rest of the way on the surface using your snorkel. Do not risk running out of air underwater.

5. To conservatively adjust for slight differences in cylinder supplies and starting pressures in buddy teams, plan your air management based on the smallest air supply.

6. Note your starting air pressure, planned reserve and turn pressure on the PADI Skill Practice and Dive Planning Slate when planning your dive for reference during the dive.

G. Swimming at the Surface

- ***Why is it a good habit to keep your mask on and a snorkel or regulator in your mouth while at the surface in water too deep in which to stand?***

1. You commonly spend time at the surface with your BCD partially inflated at the start of a dive before you descend, and at the end after you ascend.

   a. You may need to wait for your buddy to enter.

b. When exiting up a ladder, you may have to wait your turn.
c. You may descend and ascend some distance from where you enter and exit the water (more about this shortly).

2. It is a good habit to keep your mask on and a mouthpiece (snorkel or regulator) in place whenever you're in water too deep in which to stand.
   a. Under stress, you tend to do what you do by habit. When there are difficulties, you want to see and breathe effectively with your face in the water.
      - If your mask is off and/or you have no mouthpiece in, you respond more slowly if you must put them back on to see and breathe with your face submerged to deal with a problem.
      - If emergency circumstances make it better to have your mask off and/or mouthpiece out, you can remove either or both much more quickly than you can put them on.
      - Therefore, the habit that helps reduce and handle problems is having your mask on and a mouthpiece in your mouth, even when it might seem like it's not necessary.
   b. This habit also protects your vision and airway from unexpected stray splashes or waves.
   c. You're less likely to lose a mask that is on your face.
   d. It's fine to remove your mouthpiece to talk to someone when necessary, then replace it.
   e. If you will be at the surface for more than a few minutes, use your snorkel to conserve your air supply. At the end of a dive with your cylinder nearly empty, a snorkel is necessary so that you can breathe with your face underwater or in choppy conditions.

- ***What are three reasons why you may swim on the surface while scuba diving?***

3. There are three common reasons why you may swim on the surface while scuba diving.
   a. The first is to save air when you must enter the water some distance from where you want to descend and/or ascend. You stay underwater longer because you don't waste air swimming to and from your descent/ascent point.
   b. The second is to save air while you look for where you want to descend underwater. This is common in clear water in which you can see the bottom.
   c. The third is that you may have no choice if you surface away from your exit point because you're low on air.

- ***What are two methods for surface swimming while scuba diving?***

4. There are two methods you can use for surface swimming.
   a. Swim face down breathing through your snorkel. This is good when you want to see the bottom.

b. For longer swims, you can swim on your back with your head out of the water.
    - This is less tiring, because the water supports the cylinder weight.
    - It is harder to navigate and watch where you're going.
    - Even though your face is out of the water, breathe through your snorkel.

- ***How do you maintain the buddy system while swimming at the surface?***

5. The buddy system applies at the surface.
    a. Stay close enough to assist each other quickly, just as you do underwater.
    b. Use the same methods for staying together at the surface that you use underwater.
    c. Generally, it works well to swim side-by-side at the surface.

H. Descents in Open Water

- ***What are the five steps for a proper descent with scuba?***

1. When you and your buddy are ready to descend, there are five steps to follow (you will practice these during the confined water dives). This is called the five point descent.
    a. Start by confirming with your buddy that everyone is ready to descend.
    b. Together, orient yourselves to something at the surface or underwater (landmark, the boat, etc.) that can help you identify your location when you resurface.
    c. Switch from your snorkel to your regulator.
    d. Check your dive computer to be sure it is active and functioning (some may go into "sleep" mode if you were at the surface a long time before descending). Check/activate your dive timer if you're using one.
    e. Signal "descend," and, along with your buddy slowly deflate your BCD.

- ***How do you descend with and without a reference?***

2. Descend slowly with your head above your feet (makes equalizing easier and reduces disorientation), staying close to your buddy.
    a. You often have a line or slope to use as a reference.
        - Usually, you use it as a visual reference only and control your descent rate by controlling your buoyancy.
        - In some circumstances, you may use the reference to help control your descent or stay in place (such as in a current) by holding on to it. This is most commonly a mooring or descent line.
    b. To descend without a reference, stay with your buddy, adjust your buoyancy and monitor your depth with your dive computer (or depth gauge).

- ***When do you start equalizing when you descend? How often do you equalize?***

3. Remember to begin equalizing immediately, as soon as your head submerges.
    a. Equalize frequently – every metre/few feet, before you feel discomfort, as you've already learned.
    b. You will equalize more times on an open water dive than in confined water because you'll be going deeper.

- ***What happens to your buoyancy as you descend and why?***
- ***How do you control your buoyancy as you descend?***

4. In most circumstances, as you descend, your buoyancy decreases, which makes your descent rate increase.
    a. Buoyancy decrease results from the pressure compressing your exposure suit, so it is less buoyant.
    b. Offset this buoyancy loss by adding air to your BCD, or dry suit if you're wearing one.
    c. Add small amounts frequently so your buoyancy remains in control and you descend slowly. This helps you equalize every metre/few feet.
    d. Ideally, you will arrive at the bottom with your buoyancy adjusted so that you're neutrally buoyant.

I. Ascents in Open Water

- ***What are the five steps for a proper ascent with scuba?***
- ***How do you start your ascent?***
- ***What is the proper rate to ascend while scuba diving?***

1. When you and your buddy are ready to ascend, there are five steps to follow (you will practice these during the confined water dives).
    a. First, signal "up" and confirm with your buddy that everyone is ready to ascend.
    b. Second, check your dive computer to be sure you are within its limits (you'll learn more about these later in this section. If you're not using a computer, check the time for use with dive tables).
    c. Third, reach up and hold up your BCD deflator hose, but do not add air to your BCD. If you're properly weighted and neutrally buoyant, you start your ascent by swimming up gently.
    d. Fourth, ascend slowly, no faster than the rate designated by your dive computer.
        - Ascend no faster than 18 metres/60 feet per minute. With most dive computers, the ascent rate is 10 metres/30 feet per minute.
        - Most computers will warn you if you ascend too fast, so use your computer to guide your ascent rate.
        - Adjust your buoyancy so you don't start to rise too fast.

e. Fifth, look up and turn as you ascend to make sure there are no obstacles above you, and stay with your buddy.

- ***What happens to your buoyancy as you ascend? Why?***
- ***How do you control your buoyancy while ascending?***

2. As you ascend, the air you added to your BCD (or dry suit) on the way down expands. At the same time, a wet suit will expand. Both of these changes cause your buoyancy to increase; the shallower you get, the more buoyant you become if you don't adjust for this.
   a. Release air from your BCD (or dry suit) as you ascend to keep your buoyancy under control.
   b. Release air in small amounts frequently. You should ascend slowly and be able to pause your ascent without difficulty.

- ***How do you ascend with and without a reference in open water?***

3. When possible, ascend with your buddy following a reference such as a sloping bottom, mooring line or a vertical line deployed from a boat or float.
   a. A visual reference helps you control your ascent rate and maintain your orientation.
   b. You can use some references, such as mooring lines, to help slow or control your ascent. However, by controlling your buoyancy properly, this shouldn't be necessary.
   c. In some situations, such as in currents, you may ascend holding onto a reference line so you don't get carried away from the boat or exit point.
4. You may also ascend in midwater without a reference that you can see or make contact with.
   a. Ascend with your buddy controlling your buoyancy and watching your depth and ascent rate on your dive computer.
   b. To navigate while ascending without a reference, a common technique is for one buddy to focus on navigation while another controls the ascent. The team stays together throughout the ascent (You will learn basic navigation in Section Five).
   c. Although it's generally preferred to ascend with a reference, ascending without one is acceptable in many circumstances, and may be necessary in an emergency.

- ***What is a safety stop? How do you make one? When would you not make one?***

5. As a prudent, conservative diver, you will make a safety stop a normal part of your ascent procedure.
   a. A safety stop is simply a pause in your ascent between 6 metres/20 feet and 3 metres/10 feet (commonly 5 metres/15 feet) for three to five minutes.

b. Safety stops help you stabilize your ascent rate and give your body tissues extra time to release dissolved gases. Among other benefits, this helps reduce the risk of lung overexpansion injuries and decompression sickness (DCS – you will learn more about DCS in Sections Four and Five).
c. To make the stop, you and your buddy slow your ascent as you pass 6 metres/20 feet and fine tune for neutral buoyancy. Wait at 5 metres/15 feet for three minutes or longer – variations of a metre/three feet above or below are not a problem. During the stop, check your computer to be sure you didn't accidentally overstay its limits.
d. It is easiest to make a safety stop with a reference. In many environments, you can plan the dive to follow a slope upward, so that you are still on the bottom or reef while stopped at 5 metres/15 feet. This allows you to keep exploring, watching nature, taking pictures, etc., while making the stop.
e. When necessary, you can make a midwater safety stop without a reference by watching your depth gauge and hovering neutrally buoyant.
f. Safety stops add conservatism, but you don't make them during emergencies such as if you were assisting a diver who has an air supply problem, if you were very low on air, etc. You also would not usually make one if the maximum dive depth is within the safety stop range – 6 metres/20 feet or less.

- ***What do you do during the final stages of your ascent?***

6. After completing your safety stop, you complete the final stages of your ascent.
   a. Signal your buddies to confirm they're also ready to ascend from the safety stop.
   b. Swim upward gently to resume ascending.
   c. Look up and reach up with your BCD deflator in your left hand. You will need to vent expanding air from your BCD.
   d. Rotate if necessary to check for obstructions overhead.
   e. Keep your hand up as you break the surface.
   f. Continue to breathe from your regulator as you inflate your BCD. After making sure you're floating comfortably, switch to your snorkel.
   g. When diving from a boat, signal the divemaster that you're okay and swim toward it (if you didn't ascend near it).

II. Equipment 2

A. Exposure Suits

- ***What are the two reasons for wearing an exposure suit?***

1. You wear an exposure suit on most scuba dives for two primary reasons: warmth, and/or for protection against accidental stings, abrasions and cuts.
    a. As you learned earlier in the section, water absorbs heat much faster than does air. Most divers will chill without some insulation in all but the warmest water.
    b. The underwater world poses some risk of cuts, abrasions and stings from aquatic organisms. Exposure suits provide a degree of protection and reduce this risk.

- ***What are the three primary types of exposure suits and how do they differ? Which type requires special training?***

- ***Why is fit particularly important with a wet suit?***

2. There are three primary exposure suit types.
    a. Wet suits are the most common exposure suits. They provide insulation and protection, and come in a wide variety of styles depending upon how much insulation you need (more about these options shortly). They are used in water as cold as 10°C/50°F to as warm as 30°C/86°F.
        - Wet suits insulate you with foam neoprene (or other insulating material). Water seeps into the suit around your wrists, ankles and neck. Your body quickly heats the trapped water, and the material reduces the rate at which you lose heat.
        - To work, wet suits must trap the water. If water enters and exits the suit in appreciable amounts, you will lose a lot of body heat.
        - Fit is particularly important with a wet suit because if it is too loose water flows in and out of the suit, and if it is too tight it is uncomfortable. Have a dive professional assist you with getting a proper fit when choosing a wet suit. You get the best fit with a custom wet suit made specifically to your measurements.
    b. Dry suits provide the most insulation. They have special watertight zippers and seals, and keep you dry. They cover your entire body (except your head and hands with most models – you protect these with a wet suit hood and gloves). They extend how long you remain comfortable in water cooler than about 18°C/65°F, and they're the primary option for diving in water colder than 10°C/50°F.
        - The air within the suit, and an undergarment (and sometimes the dry suit itself), provide insulation, which is what makes dry suits the most effective option for cool water.

- As mentioned earlier, a dry suit is an air space that you equalize and adjust for buoyancy control. When using one, you have an inflator hose to it from your regulator. The suit also has an exhaust valve so you release expanding air as you ascend.
- Dry suits do not have to fit as closely as do wet suits, but sizing is still important. You can choose from a variety of materials, each with different characteristics and benefits. See your PADI professional for guidance and fitting when choosing one.
- It is not difficult to use a dry suit, but it does require special instruction. Ask your instructor about the PADI Dry Suit Diver course. If you'll be using one during this course, your instructor will orient you to using them during your confined water dive.

c. Skin or body suits provide little or no insulation. You wear them in comfortably warm water to protect against minor cuts, scrapes or stings, and sunburn.
- Skin suits should fit closely to avoid drag.
- In moderately warm water, you may wear a skin suit under a partial wet suit. The wet suit provides enough insulation for a comfortable dive, while the skin suit provides protection for areas not covered by the wet suit.
- You may find a skin suit makes it easier to put on a wet suit because its material slides against the wet suit's material.

- ***What exposure suit options and accessories can you choose from?***

3. All types of exposure suits have options and accessories; your dive professional can help you sort through these based on your preferences and where you want to dive. Here are a few considerations:

a. Wet suits have the most styles and options.
- Multipiece suits provide layered insulation and versatility by letting you wear different pieces depending upon the temperature.
- Choose a thicker wet suit (7 mm neoprene) for more insulation. Thinner material (3 mm) is well suited to warmer water, and is less buoyant.
- "Shorty" wet suits cover the torso and have short pant legs and sleeves. These are popular warm water suits.
- You can choose from a wide color variety and options such as zipper location, knee pads, etc.

b. Dry suit options consist primarily of your choices of materials and undergarments.
- Different dry suit materials offer advantages in terms of weight, durability and comfort.
- You choose different undergarments depending upon the water temperature – use the same dry suit in a variety of temperatures with different undergarments.

- With most dry suits you wear a wet suit hood and gloves, but dry hoods and dry gloves are options for the coldest water.

c. Hoods are important in water cooler than about 21ºC/70ºF for comfort, and because you lose a significant amount of heat through your head if it's not insulated. Your instructor or PADI Dive Center can show you appropriate hoods to go with your exposure suit.

d. When selecting a hood, or adjusting a dry suit neck seal, make sure it fits snugly, but not too tightly. A hood or neck seal that's too tight can compress arteries in your neck (the carotids), which your brain perceives as high blood pressure and responds by signaling your heart to slow. This can cause light-headedness and, if you keep the hood or dry suit on, fainting and unconsciousness.

e. You wear gloves for protection from cuts and stings, etc. and for warmth. In water colder than about 18ºC/65ºF, your fingers quickly become numb, weak and lose dexterity without insulation.
   - In warmer water, light, noninsulating "reef" gloves provide protection.
   - As the water gets colder, the choices, in order, are: wet suit gloves, wet suit mitts (three finger) and dry gloves (on dry suits).
   - Note that some countries prohibit divers from wearing gloves while diving their tropical reefs. They do this to discourage touching the fragile coral.

f. You wear wet suit boots to protect and insulate your feet.
   - You normally wear wet suit boots with open heel fins.
   - You may want boots even in warm water because they provide foot protection when walking to and from the water.
   - Fin socks provide additional comfort with wet suit boots and with full foot fins.
   - Dry suits usually have integrated boots, though a few use wet suit boots.

g. Although most BCDs have pockets, many divers like pockets on their wet or dry suits. The most popular location is on the thigh.

- ***Why is overheating sometimes an issue with exposure suits? How do you avoid overheating?***

4. Wet and dry suits are very effective insulators, so overheating can be an issue on a warm day out of the water before the dive. Your body can't cool itself effectively when you're wearing an exposure suit. To avoid this:
   a. Set up the rest of your kit before putting on your exposure suit. Put your suit on at the last possible moment.
   b. Once in the suit, limit activity and stay out of the sun as much as you can.

c. If you're wearing a hood, pull it back until just before you put on your mask and enter the water. This helps you eliminate excess heat through your head.
d. Leave the suit unzipped as long as possible.
e. If you start to overheat, take the time you need to cool off. Get in the water, have someone spray you with a hose (common on boats), or stop and take the suit partially or entirely off.

B. Cutting Tools

- ***Why do you have a cutting tool when diving (except where prohibited by law)?***

1. You have a cutting tool when diving for safety and convenience. Depending upon the type of tool, you can use it, when appropriate for safety or a task, to cut line, saw, pry or pound (don't harm aquatic life or deface wrecks, etc).
   a. Cutting tools are safety devices in case of entanglement. They are not weapons.
   b. Some areas regulate the type or size of cutting tools you can legally possess.

- ***What are the four basic types of cutting tools?***

2. There are four basic cutting tool types, each with options.
   a. Dive knife – This is a stainless steel or titanium knife, usually with a sharp cutting edge and a serrated (sawing) edge. They range in size from very compact to large. Larger knives are most likely to be affected by legal restrictions.
   b. Dive tool – This is generally a dive knife with the sharp tip replaced with a prying tool. Dive tools have the same general options as dive knives.
   c. Shears – These are special purpose shears especially suited to cutting monofilament fishing line and net. They are popular with divers likely to encounter monofilament.
   d. Z-knives – These are hooks with a blade specifically for cutting fishing line or net. You generally carry a z-knife in addition to a dive knife or tool.

- ***Where do you wear at least one cutting tool?***

3. Cutting tools have sheathes you can mount many places based on your preferences, such as on your BCD hose, on a waist strap, strapped to a leg, attached to the back of a console or on your wrist.
   a. You wear at least one tool in a place you can reach with either hand.
   b. This makes the tool accessible even if one arm is entangled.

C. Dive Gear Bags

- ***Why do you need a dive gear bag?***

1. You need a dive gear bag to carry and protect all your equipment (except weight, cylinder and dry suits).
    a. Your dive gear bag is specifically designed for dive gear. Salt water won't ruin the zippers, nor will the material rot. The bag is designed to withstand the stresses of transporting dive gear.

- ***How do you choose a gear bag?***

2. In choosing your gear bag, your PADI professional can show you many options with respect to straps, configuration, pockets and wheels.
    a. Choose your gear bag based on these, but also based on size.
    b. Select a bag slightly larger than what you need for all the gear you will have. This is because you tend to add gear as you gain dive experience.

D. Dive Instruments

- ***What are the three primary instruments you use while diving, and what do you use each one for?***

1. You've already learned a bit about some dive instruments, but let's look at them more closely. There are three primary instruments you use on virtually all dives.
    a. SPG (submersible pressure gauge) – As you've learned, this gauge tells you how much air remains in your cylinder.
    b. Dive computer – This instrument guides you to keep dissolved nitrogen in your body within accepted limits. It does this by applying depth and time information to a decompression model, constantly displaying how much time you have left.
        - Computers also tell you your time underwater, how deep you are and other information.
        - You'll learn about using dive computers in Sections Four and Five.
    c. Compass – Your compass provides a navigational reference to assist you in following a course, tracking where you are and finding your way back to your exit. Compasses designed for diving are pressure resistant and have markings to assist with using them. You'll learn about compass use in Section Five.
    d. These instruments may be entirely separate, or combined. Many dive computers read your cylinder pressure (SPG function), and some have integrated digital compasses.

- ***What three optional instruments may you choose to use while diving?***

2. You may choose to use some optional instruments.

a. Depth gauge and dive watch – Before dive computers, these were mandatory for use with dive tables like the Recreational Dive Planner (RDP) to track dissolved nitrogen in your body and plan your dive time limits.
   - You still need these if you use the RDP Table or eRDPML instead of, or with, your computer (more about why you might do this in Section Four).
   - Dive watches are still popular as diving lifestyle accessories.
   - Some dive computers are also designed and sized to be worn as watches.
   - Although not commonly used today, there are single instruments that are depth gauge and timers, but not computers.

b. Thermometer – Thermometers are useful in helping you determine how much exposure protection you need.
   - Although available as separate instruments, they are commonly part of SPGs and dive computers.
   - It is helpful to record the water temperature because it helps you determine how much exposure protection you want on subsequent dives.

- ***How do you care for dive instruments?***

3. Dive instruments have some maintenance and care considerations beyond rinsing in fresh water after use.
   a. Although robust, they are instruments. Avoid dropping dive instruments and protect them from impact.
   b. Avoid prolonged exposure to direct sunlight or high heat. Face gauges away from direct sun.
   c. Change the batteries in electronic instruments (computers) as directed by the manufacturer.
   d. See the manufacturer literature for any additional care requirements.

III. Your Skills as a Diver 2

[NOTE: Briefly review the skills student divers will learn during the second confined water dive.]

A. Deep water entry

B. Weight check and proper weighting

C. Dealing with a loose cylinder band

D. Snorkel clearing

E. Snorkel/regulator exchange

F. Neutral buoyancy

G. Mask removal and replacement, and no-mask breathing

H. Disconnecting your low pressure inflator

I. Air (gas) depletion exercise

J. Air awareness and managing your air supply

K. Five-point descent and ascent

L. Deep water exit

Summary

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Knowledge Development Three

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IV. Your Skills as a Diver 3

Outline

A. Dive Environments and Conditions

- ***What types of environments might you dive in?***
- ***What six general environmental conditions can affect you while diving?***

1. Types of dive environments
   a. One characteristic that makes diving popular is that you can enjoy it in many different aquatic environments, each with its own characteristics.
   b. Common popular dive environments include:
      - coral reefs
      - temperate water ocean
      - lakes and reservoirs
      - rivers
      - springs
      - flooded quarries
      - human-made dive environments
   c. There are six general environmental conditions that can affect you while diving. The degree that each condition affects you depends on the environment.
      - temperature
      - visibility
      - water movement
      - bottom composition
      - aquatic life
      - sunlight

- ***How can you expect depth to affect water temperature?***

2. Temperature
   a. Diving takes place in water as cool as near freezing (-2°C/28°F – requires special training and equipment) to well above 30°C/85°F.
   b. In most environments, the water temperature changes with the season, affecting how much exposure protection you should plan to wear.
      - Even most tropical environments call for more exposure protection during the winter months.
      - You can get water temperature information online for many environments. A local PADI dive operation can also usually provide this information and assist with appropriate exposure protection choices.
   c. In most environments, water gets colder with depth.
      - Water tends to form distinct layers based on temperature.

- The boundary between a warmer upper layer and a cooler deeper layer is called a thermocline. In still water like a lake or quarry, it is so distinct that you can stick your hand into noticeably cooler water below while swimming in warmer water.
- The depth at which you find a temperature difference depends upon the season and water motion. Some environments, like many rivers and springs, are the same temperature at all depths.
- It is important to base your exposure protection on the temperature at the deepest part of the dive. This is important to avoid hypothermia, which you learned about in Section Two.
- It is sometimes difficult to find out deeper water temperatures ahead of time. If you find your exposure protection inadequate for the temperature at a deeper depth during a dive, ascend to shallower, warmer water to continue the dive, or abort the dive and return wearing more insulation.

- ***How do you measure (define) visibility as a diver?***
- ***What four principle factors affect visibility?***
- ***In what three ways can reduced visibility affect you while diving? What do you do about them?***
- ***How do you avoid the potential problems of diving in clear water?***

3. Visibility
   a. Visibility influences your dive significantly. You want to learn how to adjust your dive based on the visibility, how to keep from reducing it, and determine when it's too poor to dive.
   b. You measure visibility as the distance you can see horizontally underwater.
      - This can be subjective – you may be able to recognize the silhouette of a diver who is 12 metres/40 feet away.
      - Some would call this 12 metre/40 foot visibility; others would use a shorter distance at which they can make out details.
      - Visibility ranges from 0 to more than 60 metres/200 feet.
   c. Four principle factors affect visibility at a dive site: water movement, weather, plankton and bottom/particle composition.
      - The visibility depends upon the amount of particles suspended in the water. Like a dust storm in air, a lot of particles reduces visibility.
      - Water movement (waves, current and diver fin kicks) can stir sediment up from the bottom, reducing visibility. Current can improve visibility by carrying away low visibility water and replacing it with clearer water – or vice versa.
      - The weather can reduce or improve visibility. Wind creates waves that stir up the bottom, or rain can cause sediment on land to

run off into water. Prolonged offshore wind can push upper water seaward, replacing it with clearer (and cooler) deep water.

- Plankton (microscopic organisms suspended in water) can, under some conditions, proliferate rapidly, clouding the water.
- The nature of the particle composition affects visibility. Large, heavy material settles out of the water quickly, restoring visibility. Small, light particles remain suspended for very long periods. Coarse material bottoms (gravel, sand, rock) resist stirring up and settle quickly when disturbed; fine material (mud, clay) bottoms stir up easily and tend to remain in the water for hours (more about bottom composition shortly).

d. Reduced visibility can affect your dive in many ways, but there are three effects in particular to be aware of.
   - It's more difficult to stay with your buddy. So, stay close together, take your time and watch each other.
   - Lower visibility may make it harder to track where you are or where you're going. Use your compass and other navigation clues (you'll learn about navigation in Section Five) to stay oriented.
   - When descending and ascending, reduced visibility can make you feel disoriented, especially when you can't see either the bottom or the surface. As you've learned, it helps to descend and ascend following a reference (a sloping bottom, mooring line, etc.). If you must descend or ascend without a reference, use your dive computer to help you stay attuned to your depth and descent/ascent rate.

e. Reduced visibility doesn't mean it won't be a good dive.
   - What you see is more important than how far you see.
   - As you gain experience, you become more comfortable with lower visibility. You can also learn more about the skills of diving in lower visibility in the PADI Underwater Navigator and Search and Recovery Diver courses.
   - However, if the visibility is so poor that you don't enjoy yourself, can't accomplish what you want to on the dive or it makes diving hazardous in any way, it is probably best to not make the dive (or abort it if already started).

f. Clear water can also present visibility-related problems.
   - The bottom may seem closer than it really is, so monitor your dive computer as you descend so you don't exceed your planned depth.
   - Although you can see the bottom and the surface, because they seem closer than they really are, you can experience disorientation and vertigo. Again, descend and ascend along a reference if possible.

- As you learned earlier, you can accidentally be too far from your buddy because you can see each other. Again, a good rule of thumb is to be within two seconds of each other.

- ***What two types of water movement primarily affect you as a diver?***
- ***When diving in a mild current, in what direction would you normally go? Why?***
- ***What do you do if you're caught in a current and are carried downstream from where you planned to dive or exit the water?***
- ***What should you do if you get caught in a surface current while diving from a boat and find yourself unable to swim to the boat?***

4. Water movement
    a. Two types of water motion primarily affect you while diving: waves and current.
    b. Waves result primarily from wind blowing over the water's surface.
        - The stronger the wind and the longer the distance it passes over, the larger waves can grow.
        - Waves affect swimming at the surface, as well as the techniques you use for entering and exiting the water.
        - Small waves (up to a metre/3 feet) seldom restrict diving. Larger waves may require more experience and/or training; even with experience/training, very large waves prevent diving.
        - You'll learn more about how waves affect diving later in this section.
    c. Currents result from waves, water heating and cooling, the Earth's rotation and tides.
        - Currents caused by waves vary with wind (which cause waves).
        - Water rises or sinks as it heats or cools respectively, causing currents that tend to be seasonal.
        - Currents caused by the Earth's rotation are the major oceanic currents and countercurrents. Although permanent, these currents can vary to a degree in their paths and strength due to other conditions.
        - Tides cause currents to flow to and from enclosed areas like bays, sounds and harbors. They are very predictable.
    d. You can't swim against anything but a very weak current without overexerting, so you must use appropriate current techniques and avoid all but a mild current.
        - Currents tend to be strongest at the surface and weakest near the bottom.
        - Avoid long surface swims in current.
        - When there's a mild current, begin your dive swimming slowly into the current. This is because when you turn the dive, the

current will assist you to your exit rather than carrying you away from it.

- If you get carried past your exit point or planned destination, swim across (perpendicular) to the current to reach shore, a line trailed from a boat or (in some environments) out of the current. Swimming directly against a current can exhaust you.
- When boat diving, if you get caught in a current at the surface and can't get to the boat because you're exhausted (or it is too strong and you're avoiding exhaustion), remain calm and inflate your BCD (or, drop your weights if you have a BCD problem). Use your whistle and/or visual signal devices to get the boat to pick you up.
- Diving in strong currents requires special training.
- You'll learn more about diving in mild currents later in this section.

- ***What are five types of bottom compositions you're likely to find while diving?***
- ***How do you avoid contact with the bottom? What are three reasons why it is beneficial to avoid bottom contact?***

5. Bottom composition
   a. As mentioned in the visibility discussion, there are different types of bottom compositions. You can divide them into five basic types, and you often find more than one at a dive site:
      - Silt/mud – Clay, fine organic/inorganic material or mud.
      - Sand – Larger, coarser particles.
      - Rock – Gravel and larger rock.
      - Coral – Living and dead coral in tropical water.
      - Vegetation – Various plants and algae found in both fresh and salt water.

   b. At a given dive site, the bottom may be entirely a single composition, or multiple types, such as sand bottom surrounding coral or rock bottom.
   c. Regardless of type, there are at least three benefits to avoiding bottom contact as much as possible.
      - Even with coarse bottoms, contact tends to reduce visibility.
      - Contact with some bottoms may present some hazards. In some environments such as coral and rock, you can get cuts or scrapes if you're not careful. In most marine environments, bottom contact has some risk of stings or punctures from organisms like hydroids and sea urchins. Vegetation bottoms may have some entanglement risk.
      - Many aquatic organisms that live on the bottom are fragile and sensitive. Resting or kneeling on them, or kicking them with your fin tips, can injure or destroy them.

d. You avoid contact by staying neutrally buoyant and well above the bottom.
    - Be properly weighted and trimmed. If overweighted, you tend to swim with your feet low, which makes it much easier to kick or stir up the bottom.
    - Stay streamlined and don't allow your gear to drag.
    - If you must make contact with the bottom during a dive, choose an insensitive area free of fragile aquatic life and hazards, and settle onto it gently. Similarly, on wrecks, avoid contact that would damage or deface it. If possible, rest only on your fin tips.
    - Remain aware of the bottom and watch where you put your hands and feet.

e. During entries and exits that involve wading from shore, bottom contact is unavoidable, of course.
    - Know what kind of bottom you'll wade through as you plan your dive. Be prepared for the effect on visibility, sinking into mud, etc.
    - Stop wading as soon as the water is deep enough, either by inflating your BCD and surface swimming, or by submerging and swimming underwater.
    - Wear wet suit boots to reduce the risk of aquatic life stings or scrapes/cuts from sharp rocks, etc.

- ***How does sunlight affect you as a diver? How can you avoid sunburn?***

6. Sunlight
    a. Diving typically involves exposure to direct sunshine. Besides influencing how much light you have underwater and how warm (or potentially overheated) you are before and after a dive, it can affect you by causing sunburn.
    b. To prevent sunburn, wear protective clothing and use reef-friendly sunscreen. Stay in the shade as much as possible.
    c. Protect your eyes from repeated long term exposure to sunlight with good quality sunglasses.
    d. Be aware that overcast conditions do not protect you from burning ultraviolet light.
    e. Sunburn may be the most common "injury" divers get. It can ruin a dive vacation, but it is entirely avoidable.

- ***What differences can you expect between diving in fresh water and in salt water?***

7. Fresh water and salt water
    a. There's great diving in both fresh water (lakes, rivers, quarries) and salt water (all marine environments).

b. The basic skills you learn as a diver apply to both environments, but there are some differences. Although there are exceptions, generally:
   - Fresh water is less dense and therefore less buoyant than salt. Recheck your weight and trim when going from fresh water to salt or vice versa.
   - Marine environments tend to have more types and amounts of aquatic life.
   - Very distinct thermoclines (temperature changes) within the recreational diving depth range are more common in fresh water.
   - Freshwater environments are more likely to have bottoms that you can stir up easily.
   - Saltwater environments generally have more variability in water motion – currents and waves. Tides are non existent (for practical purposes) in freshwater bodies, whereas they can significantly affect how you plan a dive in salt water (more about this later in this section).

c. In coastal areas, there are dive environments that are both fresh and salt – a shallow freshwater layer over a deeper seawater layer.

8. Whether you dive in fresh or saltwater, you may encounter places you can swim into that don't permit you to swim straight up to the surface. These are called overhead environments.
   a. Examples include inside shipwrecks, under ice and in caves or caverns.
   b. The may appear deceptively safe and simple – but they're not. They can pose hazards that you may not recognize, nor realize are present until it's too late.
   c. Your training in this course prepares you for diving in open water – with direct access to the surface at any time. As soon as you lose direct access, your risk and the potential hazards go up dramatically.
   d. You can learn to dive in these environments safely – but it requires special training and equipment to handle the added risks and complications.
   e. Do not enter a cavern, cave, wreck or any other overhead environment. One of the leading causes of diver fatalities is going into overhead environments without the proper training and equipment. Avoid this risk entirely.

B. Assessing Conditions

- ***How do you learn to assess conditions?***

1. One of the skills you will develop as a diver is how to assess conditions.
   a. This is a skill and an art based upon what you learn from your instructor and other divers (especially as a new diver), and from experience (as you go diving and continue your education).

c. Through these, you will learn to assess the dive conditions at a site based on
   - the weather
   - the season
   - water motion
   - how the water looks
   - reports online and from other divers
   - dives made at similar sites in the area

- ***What should you do if any aspect of a dive, including your assessment of the environment, causes you significant concern and/or anxiety?***

2. Your assessment should include the decision to dive or not dive. If your assessment (or any other aspect of the dive) causes you significant concern or anxiety:
   a. Get more information about the concern and how to handle it.
   b. If you cannot reasonably address whatever the issue is, do not dive. If possible, choose another site that doesn't have the concern.
   c. Remember that ultimately, you decide to dive. You are responsible for your own safety, so only you can make the final decision to dive.

- ***How do the different factors discussed in this section relate to the importance of getting an orientation when diving in unfamiliar environments?***

3. As you've seen, each environment has individual factors that differ from other dive environments. This is why, as you learned in Section One, it is important to get local environmental orientation and gain experience when diving in an unfamiliar environment.
   a. An environmental orientation helps you learn how to address what's unique about local diving.
      - Other options including taking a continuing education course with a PADI Instructor and diving with someone familiar with the local area.
   b. You learn to assess conditions locally, identify points of interest and avoid hazards. This can eliminate potential concerns that would cause you to cancel a dive due to insufficient information.
   c. Environmental orientations are important for improving your safety, but they are also part of making your dives enjoyable.

C. Diving Within Your Limits

- ***What is meant by "diving within your limits"? Why is it important to do so?***
- ***How does failure to dive within your limits raise your risk while diving?***

1. Whether you're a new diver or very experienced, dive within your personal limits.

a. This means you do not exceed the limits of your training and/or experience.
   - These limits apply to different dive environments and conditions, but also to many specialized dive activities and types of equipment.
   - It also means you dive as you were trained to, to the best of your ability.

b. It also means you do not exceed the limits of your comfort.
   - Dives should be exciting and may have some degree of challenge associated with them.
   - But, you should not have anxiety or any serious doubt about your ability to dive safely.

c. It is important to dive within your limits because failure to do so is thought to be a leading contributor to incidents and accidents.
   - Even without an incident or accident, the anxiety and uncertainty that can result usually takes the fun out of a dive.

d. Exceeding your personal limits raises your risk several ways.
   - Some forms of diving have risks that may not be obvious. These require special training in recognizing and managing these risks, without which incidents and accidents are unacceptably likely.
   - It can cause false security. Divers may "get away" with diving beyond their limits provided nothing happens, but lack the skills and/or equipment to manage the situation if a problem arises. If this leads divers to think they can dive beyond their limits and they continue to do so, when a problem does occur, the result is an incident or accident because they can't handle it.
   - High anxiety can cause divers to focus on the sources of concern but to neglect other potential problems they would normally recognize and manage effectively.

e. Be aware that even in the same general environment, different divers have may have different limits, training and equipment requirements.
   - *Example*s: Rebreather divers don't typically wear snorkels for important performance reasons. Tec divers go far deeper than recreational divers.
   - This does not change your limits and gear requirements.

- ***How do you expand your limits?***

2. Your limits grow as you grow as diver. To expand your limits:
   a. Continue your training with PADI courses.
      - The PADI Adventures in Diving program was developed specifically for this purpose.
      - Continuing education is especially important for specialized diving with unique potential hazards like rebreather diving, or cave and other forms of tec diving.

b. Dive with more experienced divers.
   - This does not replace training for activities that require it, but does help you gradually extend your current limits.
   - *Example*: You have experience with local diving, but not with visibility less than 5 metres/15 feet. It may be reasonable to dive with 2.5 metre/8 foot visibility with a buddy who is experienced with those conditions locally.

c. Gradually extend your personal limits.
   - Again, this does not replace training for activities that require it.

     Example: You have ample experience diving a dive site in a wet suit, and you are a certified PADI Dry Suit Diver, but all your dry suit experience was in a different environment. You can extend your personal limits by making dry suit dives at the site, starting with dives that are well within your capabilities.

- ***What should you do if someone subjects you to peer pressure to make a dive that is beyond your limits or that makes you uncomfortable?***

3. Divers should not apply peer pressure to get others to make a dive they're not comfortable with, or without equipment they know they should have. However, it does happen (not usually intentionally).
   a. If pressured to make a dive beyond your limits or comfort, politely say "no."
      - You can often suggest a more conservative dive or some other adjustment that keeps you within your limits and comfort.
      - When you explain that you have concerns, most divers will respect them.

   b. The rule of thumb is that if a proposed dive plan has something less conservative than your limits, decline. If a proposed dive plan adds something that is more conservative, agree.

      Example: Another diver tells you that you don't need your snorkel for a dive. You politely say that you use your snorkel and prefer to take it with you.

      Example: An experienced local diver says that in addition to a whistle and inflatable signal tube, local divers also carry a signal mirror to attract attention. You add a signal mirror to your kit.

D. Aquatic Life

1. Aquatic life is one of the appeals of diving. It is fascinating, unusual and many aquatic plants and animals are beautiful.
   a. The vast majority of organisms pose no serious threat to divers.
   b. As you approach, organisms range from having no response, to fleeing, to watching you curiously.
   c. The ability to see and (when appropriate) interact with these organisms is one of the privileges of being a diver.

- ***What are the two basic types of interactions you can have with aquatic life? Which interaction should you generally have?***

  2. There are two types of interactions you can have with aquatic life, passive and active.
     a. Passive interactions are those that leave aquatic life undisturbed: watching, photographing, etc.
     b. Active interactions are those that affect aquatic life directly, even by altering their normal behaviors: hunting, touching, moving, chasing, scaring, etc.
     c. Generally, have passive interactions.
        - Move slowly and smoothly and be sensitive to the natural rhythm of the underwater world. You will see more when you don't disturb aquatic organisms.
        - If you disturb aquatic organisms, your interactions are active, even if you mean to be passive.
     d. Active interactions can be harmless, but many can be harmful.
        - You can injure or kill some fragile organisms, like coral, just by touching them, even though your touch may seem gentle and harmless.
        - A few active interactions are reasonable, though, especially in those thrilling instances when an animal initiates the interaction, but more may be harmful – even when that's not what you intend.
     e. The goal for divers is to set good examples as the underwater world's advocates and ambassadors, helping preserve the aquatic environment for generations to come.

- ***What are the different types of potentially hazardous aquatic organisms?***

  3. Although most aquatic organisms are harmless, there are some that can injure you. Potentially hazardous aquatic organisms are, broadly, those that sting and/or puncture, and those that bite.
     a. Those that sting and/or puncture are the largest group. These include:
        - jellyfish
        - Portuguese man-o-war
        - lionfish and scorpion fish
        - stingrays
        - sea urchins
        - cone shells
        - fire coral and other hydroids
        - sea nettles
     b. Those that bite include:

- moray eels
- triggerfish
- crocodilians
- some sharks (not all)
- barracuda
- snakes (venomous bite)
- octopuses (a few species have a venomous bite)
- clawed lobsters/crab (pinchers, not a true bite)

c. Organisms that are not typically considered hazardous can cause injury if a diver fails to use common sense. For example, sea lions are not considered hazardous, but males are protective of their harems (females) during mating season, and may be aggressive if they think a diver is a threat.

- ***What causes nearly all injuries from aquatic life?***

4. You can generally avoid aquatic life injuries by being alert and aware of where these organisms live and how they behave. Nearly all aquatic life injuries result from human carelessness.
   a. Very few organisms are outwardly aggressive.
   b. Most injuries result from defensive responses by animals.
   c. Bites that seem aggressive are most often defensive (e.g., an eel may bite a hand shoved into the hole it lives in).
   d. Shark attack is very rare. Among divers, it has been associated most commonly with spearfishing because injured or dead fish can stimulate feeding behavior.

- ***What nine steps should you follow to prevent and/or handle injuries caused by aquatic animals?***

5. Here are nine steps to follow to prevent and/or handle injuries caused by aquatic animals.
   a. Be familiar with potentially hazardous organisms that may be in the local environment, where you find them and how they could cause harm. (A local orientation can help with this.)
   b. Treat all organisms with respect. Don't touch, tease or intentionally disturb them.
   c. Avoid wearing shiny, dangling jewelry, which may resemble baitfish/small prey to some predators.
   d. Watch where you put your feet, knees and hands. Exposure suits and/or gloves may help protect you, but you can still be injured through them. And, exposure protection doesn't protect aquatic life from you – avoid contact so you preserve aquatic life, too.
   e. Maintain neutral buoyancy, stay well above the bottom and move slowly and carefully.

f. Be cautious in murky water. It's easier to accidentally touch something you shouldn't. Also, potentially aggressive animals may mistake a diver for prey; it may be best to avoid diving if they're known to be in the area.

g. Generally avoid contact with all organisms, but especially avoid contact with unfamiliar organisms. Also, be aware that, while few overall, there are some stinging organisms that are very ugly or very pretty and that don't attempt to escape from divers. If you don't know how to identify the potentially harmful ones, simply be cautious when you encounter these and other creatures.

h. Be cautious with apparently dead organisms or detached body parts. Jellyfish, in particular, still sting when dead and their detached tentacles can still sting.

i. In case of an aquatic life injury, apply basic first aid :

- Assure the victim is breathing. Provide CPR or control bleeding if necessary.
- If diving in salt water, rinse stings with salt water (not fresh). Don't rub stings – it makes them worse and spreads them.
- Use vinegar on jellyfish, fire coral and other hydroid stings.
- Immerse stings from fish spines, scorpion/lionfish and stingrays in hot water (not above 49ºC/120ºF) for 30 to 90 minutes.
- Remove spines from punctures (sea urchins) with forceps if you can do so without breaking them. Otherwise, leave this for medical personnel.
- Treat bites like any wound by controlling bleeding and bandaging.
- Seek emergency medical care for bites (even small ones to avoid infection), severe reactions, large injuries or those that don't respond to treatment.
- You can learn more about handling aquatic life injuries (and other emergencies) by completing the PADI Rescue Diver course and the Emergency First Response First Aid and CPR courses.

- ***What should you do if you see a potentially aggressive animal underwater?***

6. If you see a potentially aggressive animal, like a large shark, while underwater:
   a. Remain still and calm on or near the bottom.
   b. Don't swim toward it (this may trigger a defensive behavior).
   c. Watch it. If stays in the area, calmly swim away along the bottom, keeping an eye on it, and exit the water if it seems overly curious or aggressive.
   d. Most of the time, such creatures are simply passing by. Enjoy the experience, because it is typically uncommon.

- ***Why are there laws and regulations concerning aquatic life? Why is it important that you follow them?***

  7. Most areas have laws and regulations concerning aquatic life. They exist to preserve and protect organisms, and also for human safety.
     a. Game laws/regulations exist to assure a continuing population of organisms in the future. Note that in many areas, the dive community does not take game, even where it is legal to do so.
     b. Some laws/regulations restrict access during breeding seasons.
     c. Other laws/regulations keep organisms from becoming hazardous by associating humans with food. In many areas, regulations require that only professionals with appropriate training in animal behavior conduct special activities like shark feeding for tourist divers.
     d. It is important to follow these laws and regulations to avoid legal consequences, to set a good example, and to help meet their intended goals of preserving the aquatic world for the future.

- ***What hazards may aquatic plants present?***

  8. Underwater plants do not typically directly pose significant hazards.
     a. They do, however, provide homes to other organisms, including some that sting.
     b. You can get entangled in some plants and kelp (technically an algae, not a plant, but you can consider them plants for the purposes of this discussion), though you can deal with this potential problem easily.
        - Keep your kit streamlined.
        - Don't swim through dense growth areas.
        - If you get snagged, stop. If you can, simply back up. Don't turn, which can make things worse.
        - If necessary, release entanglement by bending and snapping the plant with your buddy's help. Don't struggle, pull or twist.
        - Use your knife or cutting tool if necessary.

- ***What is Project AWARE? How can you participate in Project AWARE's mission?***

  9. Project AWARE is a movement of scuba divers protecting our ocean planet – one dive at a time. Join the AWARE movement to help keep our ocean clean, and full of healthy and abundant marine life. Project AWARE works in three ways:
     a. Diver action and awareness – aquatic life surveys, aquatic debris removal and diver courses that teach you about the major challenges facing the ocean today. Join Project AWARE to learn about ocean issues and help protect ocean life.
     b. Grassroots protection – Project AWARE supports and participates in local actions to protect the ocean. You can take part in local efforts, or start your own.

c. Policy change and advocacy – From marine park campaigns to improvements in species management, Project AWARE is making sure the highest levels of government and business hear the voice of diving.

d. Project AWARE is a nonprofit organization. You can participate in Project AWARE actions directly as a volunteer, or by making a donation.

e. Ask your PADI dive operator about local Project AWARE activities and visit projectaware.org.

E. Diving from Shore

- ***What are the procedures for entering and exiting the water when diving from shore? What are some of the considerations?***
- ***How does the environment affect the best way to wade as you walk through water shallow enough in which to stand?***

1. Most (but not all) environments offer diving from shore as an option. There are some environments that you can only dive from shore; using a boat isn't an option.
   a. As you know, you begin by evaluating the environment and conditions, and planning the dive with your buddy.
   b. Gear up as you've learned and practiced during the confined water and open water dives.
      - Remember to put your exposure suit on at the last possible moment in hot climates.
      - Work with your buddy and pace yourselves so you're ready at the same time.
      - Typically, you put on all your equipment except your mask, fins, snorkel and gloves, then conduct your predive safety check.
      - Put on your mask, snorkel and gloves just before you enter. When diving from a boat (discussed shortly) you usually put your fins on before entering. You may do that when shore diving, or you may put them on in waist-to-chest deep water, depending upon the entry technique.
      - Keep your mask on until you exit the water, and breathe from your snorkel or regulator (as appropriate) unless you're talking to your buddy.
   c. There are many ways you may enter and exit the water when diving from shore. You may
      - use deep water entries and exits from a dock.
      - climb down and up a ladder or stairs.
      - wade in from and back out to land.
      - walk down and up a boat ramp (where permitted).

d. Basic considerations when planning shore dive entries and exits include:
   - bottom composition and hazardous or fragile aquatic life if you will be wading.
   - wave, surge and current (more about these shortly).
   - the best entry and exit techniques.
   - surface swim distance (surface swims shore diving are commonly longer than when boat diving).

e. Wading to water too deep in which to stand is probably the most common entry technique. When exiting, you swim until reaching water shallow enough in which to stand, remove your fins and wade out. Bottom composition and aquatic life determine the best way to do these.
   - You can usually wade to and from water chest deep if the bottom is sand or rock.
   - With silty bottoms, you usually want to swim as soon as possible (typically about waist deep) to preserve the visibility. (This is not usually as big an issue when you exit if you're done with the dive, though it may be for divers still in the water or getting in).
   - It's wise to have foot protection to reduce the risk of cuts, scrapes or aquatic life stings.
   - If stingrays are known to be in an area, it's common to shuffle your feet on the bottom as you walk. You're less likely to step on a ray, and this encourages them to flee the area.
   - Generally, you wade into water deep enough for your BCD to support you (about chest deep), then put your fins on. When exiting, you remove your fins at about the same depth.
   - If you must wade with fins on, walk backwards looking over your shoulder.
   - Environments with deep mud that you can sink into, entangling plants, sharp rock, etc., may make it impossible to wade in. You will need to find another method of reaching water too deep in which to stand (dock, boat, etc.)

f. For exits, remember to plan your dive so that you have your reserve remaining once you're ashore. If you need to use your regulator during your exit, plan that as part of your air management.

- ***What are typical methods you should use to descend and ascend when shore diving?***

2. Descents and ascents while shore diving vary with the environment.
   a. At some dive sites, you descend immediately or soon after reaching water too deep in which to stand and follow the bottom contour downward. You ascend by following the contour back to shallower water.

b. At other dive sites, when you reach water too deep in which to stand, you remain positively buoyant and swim to where you want to dive, then descend. You do this to conserve air for the dive. After the dive, you ascend, inflate your BCD and swim to the exit on the surface.
    - You may descend and ascend along a line from a surface float you tow (more about these later in this section).
c. In yet other locations, it is common to surface-swim some distance to descend into deeper water, but to follow the bottom contour all the way back to water shallow enough in which to stand.
d. When diving through mild surf (discussed shortly), you typically descend after passing through the surf area while entering, and ascend before returning through it while exiting.

F. Shore Diving Through Mild Surf

- ***In what depth water do waves break? Why should you avoid diving in anything larger than mild surf without special training?***

1. Shore diving with mild surf begins with a basic understanding of surf and the related shore environment.
    a. Breaking waves can affect your dive plan in several ways.
    b. Entering and exiting through mild surf on a gently sloping beach isn't difficult. However, moderate to large surf requires training in the special techniques required.
    c. Avoid diving in large and rough surf. Not only can it be hazardous, but the dive conditions tend to be poor anyway.
2. Surf or the surf zone is the area in which waves break.
    a. Waves break in water only slightly deeper than their height. This is because the bottom slows the bottom of the wave, making the faster top "tip over" and break the wave.
    b. Watching waves can tell you something about the depth.
        - Waves breaking offshore indicate a shallow reef, sandbar, or wreck.
        - If waves break, reform and break again, it tells you that the bottom rises again after a deep spot as you move seaward.
        - If waves break along a continuous line but have a significant gap, it may indicate a channel, which can also be associated with rip currents (more about rip currents later).
        - The end of this subsection covers the techniques for entries and exits through mild surf, and your instructor will orient you to them further if they apply to your open water dives.

- ***What causes surge and undertow? How do they affect you as a diver and how should you adjust for them?***

3. Waves coming into shore create surge and undertow.

a. Surge is a back-and-forth motion caused by waves passing overhead. The bigger the waves, the stronger the surge and the deeper it affects you.
   - Strong surge can be hazardous because it can swing you against reef or rocks.
   - Weak surge isn't usually as hazardous, but can cause moments of disorientation.
   - You adjust for the effects of surge by diving deep enough that it has little effect, and by staying away from shallow, rock or reef areas when it is present.
   - If surge is stronger than you expected, aborting the dive is always a prudent option.

b. Undertow (also called backrush) is the water of breaking waves flowing back to sea under incoming waves.
   - The larger the waves and the steeper the beach, the stronger the undertow.
   - Diving in mild surf on a gently sloping beach, it usually isn't strong and dissipates at about a metre/three feet of depth.
   - Undertow isn't a current that carries things far out to sea, but it can cause you to lose your balance if you're not careful – waves push your upper body towards shore, and undertow pushes your feet and legs towards the sea.
   - To avoid strong undertow, avoid diving from steep shorelines unless there is little or no surf. With light undertow, be cautious to keep your balance as you enter and exit.

- ***What causes currents to move parallel to shore, and how may they affect your dive plan?***

4. Long shore current
   a. Waves usually approach shore from an angle. This causes water to flow parallel to the shoreline (called a long shore current).
   b. These currents tend to move you parallel to the shoreline during the dive.
   c. Even small waves can cause a moderately strong long shore current if they come in quickly and close together.
   d. There are several ways long shore currents can affect your dive plan, depending upon your location and its strength.
      - One option is to plan to enter the water up current and exit down current.
      - For a mild long shore current, you may plan to swim into the current for the start of the dive and let it help you return to the exit when you turn back.
      - Regardless, the main concern when planning is to account for how the current will affect your exit. This is particularly

important if there's a moderately strong current and you must exit at a relatively small, specific site on the shoreline.

- ***What is a rip current and what causes it? What should you do if you get caught in one?***

5. Rip currents result when waves push water over a long obstruction (reef or sandbar). The water can't flow back on the bottom, so it funnels back to sea through a narrow opening.
    a. Rip currents may have turbid water you can see moving away from shore, but not always. They usually create a break in the incoming waves.
    b. A rip current flows at high speed. They can be alarming because they are strong and carry you away from shore rapidly.
        - Beyond the obstruction, the rip dissipates.
    c. You generally avoid rip currents, and you may see warnings posted.
        - Most accidents associated with rip currents result from panic, not from the current itself. If accidentally caught in one, don't try to swim against it.
        - The general recommendation is to establish buoyancy and swim at a sustainable pace parallel to shore until clear of the rip area. Once clear of the rip area, you can swim back to shore.
        - In some areas, rip currents have a circular flow that will carry you back to shallow and/or currentless water.
        - In some regions, divers intentionally enter rip currents to let them carry them out to a dive site. In these areas, rip currents may make it easier to enter through mild surf.
        - A local orientation can help you identify rips and brief you on procedures if caught in one.

- ***What can cause deeper water to rise toward the surface? How may it affect dive conditions?***

6. Wind blowing from shore can push surface water away, causing cooler, deeper water to rise toward the surface to replace it. This is called an upwelling.
    a. Upwellings are most noted in the ocean, but also occur on large lakes.
    b. In many environments, upwellings are associated with excellent diving conditions because deeper water, while cooler, tends to be clearer.
    c. There are other causes besides wind that can create upwellings, though wind is the most common cause in diving circumstances.

- ***What three environmental conditions does tide generally affect? When is generally the best time to shore dive with respect to the tide?***

7. Tides are the rise and fall of the oceans; water level due to the pull of the moon and sun's gravity.
    a. Tides change throughout the day as the Earth rotates. Technically, even large lakes have tides, but the change in water level is so small as to not be noticeable.
    b. Geography and other influences cause some places to have two high and two low tides daily, and other places have only one each. The difference between high and low tides can be very extreme, or almost unnoticeable, depending upon the location and the positions of the moon and the sun.
    c. You can find the high and low tides and their relative heights for most places by checking online.
    d. Tides affect three environmental conditions related to diving.
        - Currents – Particularly when water flows to and from enclosed areas like harbors and bays, tides produce currents that change direction as the tides change. At slack tide (the midpoint at which high tide reverses to low tide and vice-versa), there is almost no current. Depending upon the location, currents can be very strong, or so mild that you don't notice them.
        - Depth – For a given site, depths will be deepest at high tide and shallowest at low tide. In some areas, the difference is enough to significantly affect your planned dive time. In other areas, the difference is not significant.
        - Visibility – Tidal currents tend to pick up sediment at high tide and carry it seaward as the tide goes out. This reduces visibility. Incoming high tide tends to bring in clearer water.
    e. Check online, with an app or with your local PADI dive operator if you're not familiar with local tides.
        - Generally, the best time to dive with respect to the tide is at high tide.
        - If outgoing tidal currents are strong, plan to end the dive and exit the water when or before high tide peaks.
        - A local orientation can help you learn how tides affect conditions.
    f. Tides affect boat dives as well as shore dives, though tidal changes are, generally speaking, most notable when shore diving.

- ***How should you enter and exit the water through mild surf?***

8. Here are the general steps for entering and exiting through mild surf.
    a. Watch the waves to note where they're breaking and their pattern. Time your entry for a lull, when waves are absent or smallest.
    b. Enter the water with all your equipment in place, except your fins, and enough air in your BCD so you would float. Breathe from your regulator (allows you to breathe in any position with your face submerged – just in case a wave causes you stumble).

c. Staying with your buddy, wade quickly toward deeper water.
   - Watch the waves. When a wave approaches, stand sideways to it for a steady balance, lean into it a bit and hold your mask and regulator as it washes around you.
   - If you put your fins on before entering (some divers prefer this), walk backwards looking over your shoulder.
   - If you're towing a float, keep it between you and the shore so a wave can't push it into you.

d. When you reach water deep enough in which to swim (waist to chest deep for most people), put on your fins and continue to swim out. The idea is to swim through the surf zone as quickly as possible.

e. Once clear of the surf zone, switch to your snorkel to conserve air if you will continue to swim on the surface. At many dive sites, you and your buddy may descend immediately once past the surf zone, or you may continue on the surface to a specific area or place you want to descend.

f. You want to use your regulator during your exit, so save enough air for the exit, in addition to your reserve.

g. When exiting, surface outside the surf zone.
   - Watch the waves and their pattern in case it changed somewhat during your dive.
   - Discuss any changes as necessary with your buddy.
   - Try to time your exit for a lull.

h. When ready, switch to your regulator and swim quickly toward shore while maintaining buddy contact.
   - If you're towing a float, push it ahead of you as you go through the surf.
   - When you reach water shallow enough in which to stand and wade (waist-to-chest deep), deflate your BCD enough to be able to stand and walk.
   - Watching the waves, remove your fins.
   - Handle waves as you did entering – hold your mask and regulator, stand sideways and lean into them.
   - Wade quickly toward shore.
   - Some divers walk out backwards with their fins on.

i. If you stumble and waves make it hard to get up, you don't need to. Just crawl until you're almost out and get your buddy to help you up. Crawling out is also an option if you find yourself very tired.

G. Diving from Boats – Preparation

1. As a diver, you will almost certainly be diving from boats at some point. In many regions, most or all diving is from boats.

a. There may not be any desirable shore diving sites.
b. Even when there is shore diving in a location, boats typically provide easier access and reach sites not accessible from shore.
c. Boat diving usually avoids long walks with gear on, and usually eliminates the need for surface swims of any appreciable distance (though you should always be prepared for one if you have to surface due to a problem).
d. You can dive from larger boats (typical dive charter boats) that carry six or more passengers, small runabouts and even kayaks are used at times.

2. If you're not accustomed to boats, you may not be familiar with the names given to different parts and directions on them. Different regions and languages may use some different terms.
   a. The bow – the front of the boat. "Forward" means toward the bow.
   b. The stern – the back of the boat. "Aft" means toward the stern.
   c. Port – The left side of the boat as you face forward.
   d. Starboard – The right side of the boat as you face forward.
      - "Port" and "starboard" reduce confusion because they are always relative to the bow. "Left" and "right" can be confusing because they may be relative to the person speaking.
   e. Leeward – The side away from the wind. It is often pronounced "loo-erd."
   f. Windward – The side toward the wind.
   g. The bridge (wheelhouse) – The elevated portion of the boat where the controls are.
   h. Head – Generally, the boat's toilet facilities. It also refers to the boat's commode specifically.
   i. Galley – The boat's kitchen/cooking area (in some areas, most dive boats have galleys; in others, almost none do).
   j. Swim step – On larger boats, a platform on the stern that is close to water level. You commonly enter and exit the water there.

- ***How should you pack and prepare your gear for a boat dive?***
- ***How should you prepare yourself for a boat dive?***

3. You want to prepare your gear and yourself for a boat dive.
   a. To prepare your gear:
      - Inspect it and make sure it's working. On a boat, you don't have many options if something is broken.
      - Mark your gear so it doesn't get mixed up with someone else's. Your PADI dive operator can show you different types of gear markers.

- Use a proper gear bag for everything except your cylinder and weights. Pack so what you need first is on top. Space is limited on many boats, so work in and out of your bag as much as possible.
- Have what you need for the time on the boat – dry clothes, beverages, snacks, sunscreen and towels. Some of these may be provided on a charter dive boat, but know what you need to bring.
- Arrive ahead of time and stow your gear and personal items as directed by the crew.

b. If you're not used to boats, there are a few ways to prepare yourself to make the trip part of the excitement diving offers.
   - Be well rested, especially for an early departure. Avoid excessive alcohol the night before (a recommendation before any day of diving, actually).
   - Eat well balanced meals and avoid foods that you don't digest well. Drink plenty of water, juices (but avoid particularly acidic ones), etc. so you're well hydrated.

- ***How can you prevent seasickness? What should you do if you begin to feel seasick?***

4. Seasickness (motion sickness) can ruin a day on a boat, but for most people, it is preventable.
   a. People vary in how prone they are to seasickness. Some are virtually immune and others very susceptible.
   b. The usual precaution is to take seasickness medication.
      - In most areas, suitable medication is available without a prescription. If you have questions about a particular medication, ask your physician.
      - You have to take most medications several hours before departure. Consult the medication instructions and follow them, or the instructions of your physician.
      - Generally, avoid greasy or hard to digest foods while underway. Many people find it helps to avoid intricate tasks and reading.
   c. If you do feel motion sick, while it is very unpleasant, it seldom has a long-term health risk.
      - Stay in open, fresh air and look at the horizon or close your eyes. Try to be as close to the water and near the center of the boat as possible while still in fresh air. Do not go in the head (toilet facilities – that's the worst place you can go) and stay away from engine exhaust.
      - If you are going to throw up, go to the leeward rail (side of the boat with the wind coming toward your back) to do so. Take someone with you so you don't fall over the side.

H. Diving from Boats – Procedures

- ***Why is a roll call important for your safety?***

1. Before leaving the dock, most charter dive vessels usually conduct a roll call.
   a. Generally, everyone on board is on the roll – even nondivers. Be sure your name is on the roll.
      - Some dive boats have special marker boards or other procedures for noting who is aboard.
      - Follow the boat's procedures.
   b. After each dive, the crew calls roll, or uses some other specific procedure, to confirm that everyone is aboard. This is important for your safety because it greatly reduces the risk of accidentally leaving someone at the site.
      - Also, do not answer for another diver during a roll call, even if you're "sure" the person is aboard.
   c. On small boats, or large ones with few passengers, it may not be necessary to have a formal roll call. The crew will, however, still have an established method to verify that everyone is aboard before leaving each dive site.

- ***How should you gear up and move around on a dive boat? Why is it important to secure your equipment on a boat?***

2. Predive preparation and gearing up for a boat dive.
   a. The ride to the dive site may take minutes or several hours, depending upon where you are.
      - If it is only minutes, you may get into all your gear before the boat leaves the dock.
      - More typically, you set up your kit, but wait until the boat nears or arrives at the dive site to put on your exposure suit and gear up.
      - Often, you set up your scuba kit, test its function and confirm a full cylinder some time before you dive. If so, when done, close the cylinder valve and purge the regulator until you get to the site.
      - In most instances, you plan your dive with your buddy just before or as you kit up.
   b. Be careful moving around on a dive boat, especially when carrying or wearing gear. It is easy to lose your balance, especially when there are a lot of waves.
   c. Even in calm conditions it's important to secure your equipment on a boat because equipment can fall and injure someone, break or go over the side if the boat rocks for any reason, such as wake from a passing vessel, etc.
      - Always secure your cylinder/scuba kit so it can't fall. If you're working with it and must walk away from it, resecure it.

- On some boats, you secure it by laying it down. Do so with the cylinder down, BCD up, and block it so it can't slide or roll.

- ***What are the general procedures and considerations for entering the water when diving from a boat?***

3. General procedures and considerations for entering the water from boats vary with the boat, its size and where you're diving. Most of the procedures and considerations discussed here apply to the majority of charter dive boats.
   a. The divemaster will usually give a dive site briefing. If is the first briefing for the day, the briefing may also cover general diving procedures, safety issues and other information that won't have to be repeated before every dive.
      - One safety consideration may be the boat's emergency recall signal and procedure. Generally, the procedure is to carefully surface at a safe rate with your buddy where you are if you hear the boat's recall signal (it may be an underwater alarm, repeated pounding on the boat ladder or other noise). At the surface, look to the boat for instructions. The procedures may vary depending upon the environment and conditions, however.
      - The briefing may include information that relates to the best sights underwater, possible hazards and the conditions. All of these affect your dive plan, so listen to the briefing.
      - If you don't understand something, speak up and ask questions.
   b. Before entering the water, know how you'll get back aboard (usually covered in the briefing). While this is often obvious, sometimes it's not. Be sure you know the procedures for exiting the water before you get in.
   c. Check the conditions and note current direction (if there is one) so you can swim into the current while underwater (the boat usually points into the current, but may not if there is a strong wind).
   d. On small boats, you may gear up seated and back roll into the water. Another common method is to inflate your BCD, then put your kit in the water and get into it after you get in.
   e. On many large dive boats, you gear up while seated.
      - Put on everything except your fins.
      - When your buddy is ready, conduct your predive safety check seated or standing, depending upon the situation.
      - Go to the entry area and let the divemaster know you're ready to get in. Put your fins on using a rail or buddy assistance for balance. Avoid walking with fins on any more than you must.
   f. On some boats when diving in relatively calm water, you gear up while standing using the procedures you practice during the confined water dives (unless physically unable to do so).

- Procedures vary depending upon the boat design and the environment. Follow the crew's recommendations.
- Most dive boats do everything reasonably possible to accommodate special physical needs, including entry and exit techniques. Let the crew know if any apply to you.

g. If you will be taking special equipment (like a camera), ask the divemaster/crew to hand it to you after you enter the water.

h. For a given situation, the best entry technique to use is usually the easiest one. The crew will usually recommend a technique appropriate for the boat, the conditions and your physical characteristics.

- ***What are typical methods you may use to descend and ascend when boat diving? Why is it important to stay well away from a dive boat's propeller?***

4. Descending and ascending when diving from a boat.

a. When boat diving, you commonly do not have the bottom to follow for at least the beginning of descents and the end of ascents.
   - You may have a descent line (vertical weighted line) or use the mooring/anchor line as a reference for at least the beginning of your descent.
   - In clear, currentless water, you may simply use your dive computer and BCD (or dry suit) to monitor and control your descent.
   - After reaching the bottom, you may follow the bottom further downward.
   - On some occasions, you surface swim from the boat to a designated descent/ascent area.

b. As you've already learned, you normally swim into the current on the bottom or at your planned depth for the first part of your dive.
   - In most situations, this means you swim generally in the direction the boat's pointed and stay in front of the boat (there are exceptions – the crew will brief you accordingly).

c. When you reach your turn point based upon your planned time, air use or other limit, turn around and head back to the boat.
   - You return to the mooring/anchor line or descent line. In clear water with little or no current, you return to where you can see the boat above you.
   - If you have more air/time remaining than required for your ascent, safety stop and reserve, you and your buddy can explore the immediate area until it's time to go up.

d. You usually ascend following the same references you used to descend. That is, you may follow the bottom upward until you reach the mooring/anchor line, then follow it upward.

e. It is common to make your safety stop next to a line for reference, though you may do so on the bottom if the boat is moored/anchored in 6 metres/20 feet to 5 metres/15 feet of water.
    - Sometimes you make the stop without a reference using your dive computer to monitor depth.
    - Many dive boats hang a bar or line as a convenient place to make a safety stop.

f. Stay well away from the dive boat's propeller(s). Do not approach it or get near it, even when the boat engine is not running.
    - A boat propeller can inflict catastrophic injuries with little warning. Boat propeller injuries are commonly fatal; those that aren't are usually leave permanent disabilities.
    - Treat propellers as though they will start turning with full force at any time without warning – because they can do so.
    - If you see something that requires attention relating to the propeller (e.g. a rope entangling it), do not attempt to clear it. Inform the crew; they will deal with it appropriately.

- ***Why should you avoid swimming just below the surface?***

5. In most circumstances, you surface near the boat.
    - Generally, you surface in front of or next to the boat. Signal to the crew that you're okay (assuming you are).
    - If there is no current, just behind the boat is acceptable.
    - Stay where you're visible to the crew.

b. Sometimes, you may have a surface swim when boat diving.
    - It may be planned to reach a descent/ascent area some distance from the boat's mooring/anchoring location.
    - You may have to surface away from the boat due to running low on air sooner than expected.
    - If you get disoriented, surfacing may be the easiest way to relocate and return to the boat.

c. When on the surface (whether diving from a boat or from shore) and there is boat traffic, watch for approaching vessels. Use surface signaling devices so boaters know you're present (more about these devices shortly).

d. Do not swim just below the surface because you are invisible to boats and could be struck. Either be fully visible at the surface, or stay deep enough to be safely below boats.

- ***What are the general procedures and considerations for exiting the water when diving from a boat?***

6. The general procedures and considerations for exiting the water when boat diving depend upon the vessel and the conditions. You'll practice some of the techniques during your confined water dives.

a. On larger dive boats, a common practice is to board with all your gear on, except fins, by climbing a ladder.
    - Stay out from underneath divers climbing the ladder while waiting your turn, just in case they fall back or some of their gear slips.
    - If there is a current, while you wait you normally hang onto the trail line, which is simply a rope with a buoy trailing behind the boat for that purpose.
    - When it's your turn, switch from your snorkel back to your regulator and swim (or pull yourself via the trail line) to the ladder.
    - Hand up specialized equipment (e.g. a camera) if carrying any.
    - Keep hold of the ladder while you remove your fins. You may hand them up, though some divers prefer to slide their hands through the heel straps and wrist carry them (that way they still have them if they lose their grip and need them to swim against the current).
    - Breathe from your regulator and keep your mask on until you're all the way aboard.
    - Especially if the boat is rocking, sit as soon as possible and/or have someone help you out of your gear. Secure your kit immediately.

b. On small boats, a common technique is to inflate your BCD and slip out of your kit while in the water at the surface.
    - If your weight system isn't integrated, you usually hand it up first.
    - Someone aboard may lift your kit aboard, or you may secure it to a line to retrieve yourself.
    - If there's no ladder, keep your fins if they will help you lift yourself from the water.
    - If physical limitations keep you from climbing a ladder with your kit on, this is usually an acceptable technique on a larger boat, too.

- ***What are the general procedures for diving from a boat in a moderate current? How should you use a trail (tag) line, swim line and mooring/anchor line when diving from a boat in a moderate current?***

7. In many popular dive locations, it's normal to have a mild to moderate current. To keep from having to fight the current, you use lines to hold your place during your descents and ascents. By using these lines, the current doesn't carry you away from the boat and you reduce the risk of overexertion. (Note that strong currents require special training).
    a. The boat will typically have three lines you use:
        - The trail line (a.k.a. tag line, current line) is the previously discussed line trailing behind the boat.

- The swim line runs from the stern along the side of the boat to the mooring/anchor line. It is typically within reach of the trail line.
- The mooring or anchor line secures the boat in place to the dive site.

b. After your predive safety check, etc. enter the water and wait for your buddy on the trail line at the surface.

c. When everyone is ready, switch to your regulator. You and your buddy pull single file along the swim line to the mooring/anchor line, then continue hand-over-hand down it to the bottom.

d. The current is typically weaker on the bottom. Swim into the current as you would normally. Make the entire dive up current from the boat. Turn the dive as planned (air used, time, etc.) and return to the mooring/anchor line with ample air for a safe ascent and safety stop.

e. Ascend the mooring/anchor line. As you ascend, the current may become stronger, so as needed, maintain contact to keep from drifting downstream. Make your safety stop on the mooring/anchor line.

f. Complete your ascent up the mooring/anchor line and follow the swim line back to the trail line. Wait on the trail line until it's your turn to exit.

g. If you lose contact with a line and cannot regain hold in the current:
- Surface (if not already on the surface) and swim across the current to intercept the trail line. Don't try to fight the current. The more current there is, the longer the trail line usually is.
- If you miss the trail line, inflate your BCD and signal the crew that you need them to pick you up. Relax and deploy your surface signaling devices. It may be awhile before the boat comes after you if the crew is still picking up divers.

h. The crew may advise you of other procedures they use on their vessel in the local environment.

- ***What should you do if you surface from a boat dive and the boat is not in sight?***

8. It's not likely, but if you surface and the boat's not in sight, stay calm and get buoyant.

a. Relax and wait to get picked up. The boat may have slipped anchor, or the captain may have had to leave in an emergency (to pick up other divers).

b. If there is a mooring or anchored float in place, hang onto it.

c. Deploy your surface signaling devices so it's easier for the boat to spot you when it returns.

d. If the shore and a reasonable exit area are close and in sight, swim slowly toward them.

I. Dive Planning

- ***What are the four stages of dive planning?***

1. Let's expand on what you've already learned about dive planning. We can divide planning into four stages, each with its own characteristics:
   a. advance planning
   b. preparation planning
   c. last-minute preparation
   d. predive planning

- ***What should you do during the advance planning stage?***

2. Advance planning begins with the decision to go diving. What you do at this point is general, but typically includes:
   a. Deciding on whom to dive with, including buddies, dive operators, boats, etc.
   b. Choosing a dive site
      - Initially, this may be general, with a specific site chosen when you're ready to dive.
      - It may also be very specific if required for your dive objective.
   c. Agreeing on an objective (i.e., what you want to do on the dive).
   d. Scheduling logistics – where and when you will meet, get in the water, etc.
   e. Checking dive conditions, as well as weather, wave and surf information, conditions, etc., at ScubaEarth and other online sources, as well as through a local dive operator.

- ***What should you do during the preparation planning stage?***

3. Preparation planning usually begins at least a day or two before the dive. Typically, you
   a. inspect your gear to be sure it's all working properly and together. This gives you time to have something serviced or replaced if necessary.
   b. have your scuba cylinder filled.
   c. recheck weather and conditions and reconfirm with your buddy as appropriate, especially if it has been several days.
   d. start packing your gear bag – you may put some things in it right before you go, but you can stow most of it after you confirm it's working okay.
   e. Many active divers stay "permanently prepared" by always having their gear ready and by regularly checking conditions.

- ***What five steps should you follow during the last-minute preparation planning stage?***

4. Last-minute preparation is what you do a few hours before to right up to when you leave for the dive site. Typically, you'll include these five steps:
    a. Go online or use an app to recheck the weather, surf and/or dive conditions as appropriate.
    b. Let someone know where you're going, when you expect to be back and what to do if you're delayed. Give that person your mobile number.
    c. Gather personal items you'll want, such as a jacket, your certification card (or have it as an eCard in your smartphone), tablet computer, sunscreen, ice chest, beverages, lunch, etc. These items vary depending upon the dive.
    d. Pack anything that didn't already go into your gear bag such as an exposure suit you left out to dry over night.
    e. Double check that you're not forgetting anything.

- ***What seven steps should you follow during the predive planning stage?***

5. Predive planning is the actual dive plan during which you settle on details and make decisions based upon what you find at the dive site. The idea is to anticipate, discuss and plan for as much as reasonably possible before the dive. You've already been learning these, and the PADI Skill Practice and Dive Planning Slate lists reminders:
    a. Evaluate the conditions. Take the time you need to do this, especially if you may be entering the water through waves, or if there may be a current present.
    b. Decide whether the conditions are acceptable for diving. If not, go to an alternate site or cancel diving altogether. Diving is supposed to be fun and rewarding; if it won't be, do something else.
    c. Agree on techniques, including where/how to enter, the course to follow, techniques you'll use during the dive and where/how to exit.
    d. Review signals and communications as necessary.
        - You may need little or no review with buddies you dive with often.
        - Spend time on it with new buddies, or if you'll need special signals for what you're doing on the dive.
    e. Agree on buddy separation procedures.
    f. Agree on time, depth and air supply limits.
    g. Discuss what to do if an emergency arises.

- ***What considerations should you have when you plan extended dive travel?***

6. Planning extended dive travel (i.e., a dive trip to a remote destination, typically involving staying one or more nights) has some considerations in addition to the four dive planning stages.
    a. Determine what gear to take and what not to take.

- When traveling by air, you usually rent cylinders and weight at your destination. Confirm anything else you may choose to rent at the destination before you go.
- Check with the airline ahead of time regarding baggage allowances. Weigh your bags to avoid surprises when you check in.

b. Take your log book and certification card to document your experience and qualifications.
   - Online logs and eCards reduce what you need to carry (and help if you forget).
   - PADI Resorts have access to the Dive Chek system, which allows them to confirm your certification if you forgot it.
   - You can replace lost cards at ScubaEarth.

c. If you're new to dive travel, it helps to make your first trips with experienced dive travelers.
   - Go on a trip led by your PADI Dive Center, a dive club or other dive group.
   - Even with experience, many divers prefer group travel because it provides social activities and a way to make new friends.

d. Research the destination so you know any special requirements, the weather to expect, the types of diving available, ground transportation, local customs, etc.
   - Most destinations have online sites, and ScubaEarth has destination information.
   - Websites for the area's resort dive operators usually have more detailed diving information.
   - Social networking sites with dive groups can give you personal insights as to what to expect.

e. Learn something new.
   - Dive travel often lets you try dive activities that you can't learn in your local area. For example, if you live in a warm climate, you may have no local need for a dry suit, but a cool, temperate destination would be a good place for the PADI Dry Suit Diver course.
   - Continuing education courses and special activities add to the fun of dive travel, and expand the locations you're qualified to visit.

f. If appropriate, plan to do more than dive.
   - The diving lifestyle involves more than diving; it includes sightseeing, other sports and getting a glimpse of new parts of the world above water as well as underwater.
   - Even dive trips that are primarily dive-focused (like on most liveaboard dive vessels) usually offer these opportunities.

II. Problem Management

A. Preventing Problems

1. Diving has a better safety record than many other sports and activities, but you still face hazards and risks.
   a. It is common sense that because you can't breathe water, being in and under water presents some risk.
   b. You have also learned potential risks associated with breathing compressed air (or other gases) underwater and how to manage and avoid the associated problems.

- ***What approach to diving can help you prevent and manage problems?***

2. The guidelines and procedures you learn in the course help you reduce and control the risks of diving. But, you can never completely eliminate risk.
   a. Diving within your limitations, planning your dives, staying physically fit, maintaining your dive skills and following safe diving practices will help you avoid problem situations.
   b. There is an approach to diving that can help you prevent problems. It is this: To the best of your ability, always follow safe diving guidelines, have the recommended equipment and do as you've been trained, even when it doesn't seem necessary.
      - As previously discussed, under stress you tend to do what you do by habit, so maintain habits that prevent problems and help you when one arises.
      - Because you are human, you will make mistakes. The procedures and equipment requirements you learn help address this by providing a margin for error. When you don't follow your training, you reduce this margin.
      - Unfortunately, problems don't announce themselves in advance. The more you stray from proper diving habits and gear requirements, the more likely problems are, and the less prepared you will be to handle them. The more you stick with proper habits and equipment, the fewer problems you'll have and the better prepared you'll be to deal with them.

- ***How does continuing your diver education improve your ability to manage problems? What four courses are recommended?***

3. Having a good first aid kit and emergency oxygen unit is important for managing problems. You should also know how to use them and continuing your diver education improves your ability to manage problems by extending and refining emergency skills, developing new ones, and giving you practice with both.
   a. If you plan to dive where secondary assistance (paramedic, lifeguard, divemaster, instructor, etc.) is either remote (due to time or distance) or unavailable, you should have additional training.

b. Continuing your education in these four courses is recommended in any case.
    - The PADI Advanced Open Water Diver course broadens your experience in (among other things) planning dives and evaluating conditions under instructor supervision.
    - The PADI Rescue Diver course expands on your dive emergency training with extensive skill development and hands on practice. It provides an environment for learning techniques best suited to you.
    - The Emergency First Response Primary and Secondary Care courses teach you CPR and first aid. These emergency skills have application outside of diving.
    - The PADI Emergency Oxygen Provider course qualifies you to provide oxygen in diving emergencies. This is a primary first aid step for serious medical emergencies in diving.

c. Ask your instructor for more information about the availability and scheduling of these programs.

B. Surface Problem Management – Responsive Diver

- ***In what three ways can you prevent or control most dive problems that occur at the surface?***

1. Most diver-in-distress situations occur at the surface.
2. You can control or prevent experiencing a surface problem yourself by
    a. diving within your limits.
    b. relaxing while you dive.
    c. establishing and maintaining positive buoyancy when you're on the surface.
3. You've already learned to prevent and handle many surface problems, and you will practice doing so during your confined and open water dives.
    a. Possible surface problems include overexertion, leg muscle cramps and choking on inhaled water.
        - As you learned, avoid overexertion by staying relaxed. If you start to overexert, be sure you're buoyant, stop all activity and rest. Signal your buddy or instructor, and don't hesitate to ask for assistance.
        - Leg cramps result from involuntary muscle contractions, and tend to be more common if you have not been diving for awhile because your muscles aren't used to swimming with fins. You practice relieving cramps during your training dives.
        - You've learned that airway control helps prevent choking on inhaled water, as does keeping your mask on and your regulator or snorkel in your mouth. If you do choke on a bit of water at the

surface, be sure you're buoyant, and cough into your regulator or snorkel while you hold it. Swallowing may help, too.

- ***What should you do if a diving-related problem occurs at the surface?***

4. If a diving-related problem occurs at the surface, you should immediately establish buoyancy by inflating your BCD or dropping your weights.
    a. Stay at the surface using the least energy possible – by floating, not by kicking.
    b. Don't hesitate to drop your weights. Be cautious about divers who may be below, but it is never wrong to drop your weights (they can usually be recovered).
    c. Stop, think and then act.
    d. If you need help, ask. Asking for help when you have a small problem often avoids a big problem and makes everything easier for you, your buddies and the divemaster/crew.
    e. Use your surface signaling devices to whistle, wave or otherwise attract attention when you need assistance.

- ***How do the appearance and actions of a diver who needs help and is in control (not panicked) differ from a diver who needs help and is out of control (panicked)?***

5. A diver who is breathing, alert and active is considered responsive. Before you can help a responsive diver, you have to recognize the need for help, and you need to know the diver's state of mind.
    a. Divers who are in control (not panicked) and need help usually signal or ask for assistance.
        - They appear relatively relaxed, and move with controlled, deliberate actions.
        - If able, they typically respond to and follow instructions.
        - Divers in control keep their gear in place (except weights, which they may drop) and establish buoyancy.
    b. Divers who are out of control (panicked) have been overcome by sudden, unreasoned fear that displaces deliberate, controlled actions for instinctive, inappropriate and often repetitive actions.
        - Panicked divers fear drowning and struggle violently and expend tremendous energy to stay at the surface, even until they are exhausted.
        - Divers who have lost emotional control typically fail to establish buoyancy. They may climb upon anything or anyone they think will keep them from sinking.
        - They often have their masks on their foreheads or gone altogether, and don't use their breathing equipment.

- Panicked divers usually have wide, unseeing eyes and do not follow instructions. They pay no attention to others, and have quick, jerky movements.
- Panicked divers need immediate help because they may continue to struggle until exhausted, at which point they are at risk of sinking and drowning.

- ***What are the four basic steps for assisting a responsive diver at the surface?***

6. There are four basic steps for assisting a responsive diver at the surface.
   a. Establish buoyancy for yourself and the diver.
      - Always begin with buoyancy. You greatly reduce the immediate risk by assuring neither of you will sink.
      - The ideal way is to throw or extend flotation to the diver.
      - If you must make contact to help, make yourself buoyant before doing so.
      - Inflate the victim's BCD and/or drop weights.
   b. Calm the diver by reassuring, offering encouragement and asking the person to relax.
      - A diver in control stays in control with reassurance.
      - A panicked diver usually begins to regain control once buoyant. Reassurance usually helps.
   c. Help the diver reestablish breathing control.
      - Have the diver take slow, deep breaths to encourage relaxation and self-control.
      - If possible and appropriate in the circumstances, give the diver a chance to rest and recover before any further action.
   d. As necessary, assist the diver to the boat or shore.
      - Even divers who don't panic may need assistance due to leg cramps, etc.
      - You practice appropriate diver tows during your training dives.

C. Surface Problem Management – Unresponsive Diver

- ***What are the primary concerns with an unresponsive diver?***

1. An unresponsive (unconscious) diver at the surface needs immediate help.
   a. Inhaling water, extreme fatigue, entanglement, heart attack and lung over-expansion injuries, among other possible causes, may cause unresponsiveness.
   b. Panic, inefficient breathing, throat blockage, and exhaustion can also contribute.
   c. The primary concerns are to check for breathing and to begin rescue breathing if the diver isn't breathing.

- ***What does an unresponsive diver at the surface look like?***

2. An unresponsive diver does not move and does not respond when tapped on or spoken to.
    a. Equipment may or may not be in place.
    b. Commonly, the diver does not have significant buoyancy.
    c. The diver will drift in a current.
3. The diver may not be obviously unresponsive.
    a. An unresponsive diver floating face down may appear to be resting or watching something underwater. Confirm responsiveness if a diver floats without moving for more than a few moments.
    b. Assume a diver who is floating in an odd position (e.g., legs at the surface, bent at the torso with the head at the deepest point) and not moving needs help until you confirm otherwise.
    c. A diver who surfaces alone, calls for help or shows signs of panic, then stops moving, should be considered unresponsive until you confirm otherwise.

- ***What are the four basic steps for assisting an unresponsive diver at the surface?***

4. To assist an unresponsive diver at the surface, you follow these four basic steps.
    a. Establish buoyancy for the victim and for yourself.
    b. Call for help to the boat or shore.
        - Others can assist the rescue by helping with towing the victim, preparing emergency equipment, alerting emergency medical services and so on.
    c. Check for breathing and begin providing rescue breaths if it is absent as you tow the diver toward the boat or shore.
    d. Continue rescue breathing (if needed) as you help get the diver out of the water.
    e. We'll look at what to do once you're out of the water shortly.

D. Underwater Problem Management

- ***In what three ways can you prevent or control most dive problems that may occur underwater?***

1. You can prevent or control most dive problems that may occur underwater by (these should sound familiar)
    a. relaxing while you dive.
    b. planning your air use with your buddy and watching it closely.
    c. diving within the limits of your experience and training.

- ***How should you prevent and respond to overexertion underwater?***

2. Overexertion has been covered previously, but it is one of the most common underwater problems and bears repeating.

a. As you learned, dive relaxed to prevent overexertion. Breathe slowly, deeply and continuously, and pace yourself.
b. Overexertion may create a feeling of air starvation because breathing resistance increases with depth.
   - The problem is overexertion, though it may feel like the regulator doesn't deliver enough air. Technically, you're demanding more than it can supply.
   - Avoid this by avoiding strenuous activity.
c. If you start to feel overexerted – air-starved and unable to catch your breath – stop all activity. Do not ignore the feeling. Rest, relax and breathe slowly until you restore your normal breathing pattern.
   - Signal "hold" and indicate that you need to rest.
   - Continue at a reduced pace after you recover.
   - If you can't return to a relaxed state, end the dive.
   - If conditions are contributing to overexertion, it may be best to abort the dive.

- ***How should you breathe from a freeflowing regulator?***

3. Modern regulators are highly reliable and designed so that if they fail, they release air continuously (called a freeflow) rather than cut it off.
   a. You can breathe from a freeflowing regulator.
   b. To do so, do not seal your mouth on the mouthpiece.
      - There is some risk of lung overexpansion injury if the flow is high.
      - More likely, the regulator will not stay in your mouth, and may flood your mask.
   c. Hold the second stage in your hand and press the mouthpiece outside your lips.
      - Let the excess air escape freely.
      - You may insert one end of the mouthpiece if it helps.
      - Breathe the air you need by "sipping" it, somewhat like drinking from a water fountain.
   d. Begin your ascent promptly. A freeflow will exhaust your air supply quickly.
   e. Have a regulator that freeflows serviced professionally before using it again.
   f. You'll practice breathing from a freeflowing regulator during confined water dive training.

- ***What should you do if you become entangled underwater?***

4. Entanglement is rare, but fishing line, loose line from a reel, and old fishing nets have the potential to cause it. Some aquatic plants, as mentioned earlier, have entanglement potential.

a. Prevent entanglement by moving slowly, watching where you're going and keeping your equipment streamlined.
b. Entanglement is usually not an emergency if you have adequate air. If you become entangled:
    - Stop, think and work slowly and calmly to free yourself.
    - Get your buddy to help.
    - Avoid turning or twisting, because this tends to wrap what's entangling you around you.
    - If severely tangled or low on air, you may need to use a cutting tool. If so, use caution – don't cut yourself or your gear. With tough line, disentangling may be faster than cutting.
    - In extreme cases, you may have to slip out of your scuba kit, free it and put it back on (this is one reason you practice removing and replacing your scuba rig underwater).

- ***How should you prevent running low on or out of air underwater?***

5. Running out of air is one of the easiest problems to avoid, and stoppage due to malfunction is highly unlikely due to regulator design.
    a. Plan your air use, including a reserve, during dive planning.
    b. Check your SPG often.
    c. If you run low before your reach your planned ascent point, ascend where you are while you still have adequate air to do so.
        - It is better to have a long surface swim than to run out of air underwater.
        - Ascending with adequate air allows you to control your ascent and to make a safety stop.

- ***In order of priority, what are your four options if you run out of air underwater?***

6. Although you should avoid running out of air or very low on air, you should know the four options to consider, and when to apply each. Remain calm, quickly consider each and then act intelligently based on your training.
    a. Make a normal ascent.
        - Do this if you're very low on air (you feel some breathing resistance), but your cylinder isn't completely empty.
        - As you ascend, you can get more air from your cylinder because the surrounding water pressure decreases.
        - Breathe lightly (but continuously) and make a controlled, continuous ascent to the surface.
        - Do not attempt a safety stop.
    b. Ascend using an alternate air source.
        - Think of this is as your best, all around choice when you have an alternate air source immediately available.

- Check what alternate air sources will be available and how to secure and work them during your predive safety check.
- To use an alternate supplied by a buddy, you need to stay close to your buddy.

c. Make a controlled emergency swimming ascent (sometimes called CESA).
   - This is the best choice if you were completely out of air, no deeper than approximately 6 to 9 metres/20 to 30 feet, too far from your buddy or another diver and have no other alternate air source.
   - Simply look up and swim to the surface making a continuous ahhhhh sound into your regulator. The ahhhhh sound assures you exhale expanding gas to avoid lung overexpansion injury.
   - Leave all your gear in place and keep the regulator in your mouth. Do not drop your weights to start your ascent.
   - Ascend at a safe rate. The ascent gets easier as you ascend because air expanding in your BCD increases your buoyancy.
   - You practice this during your confined water and open water dives.

d. Make a buoyant emergency ascent.
   - Use this option in an out-of-air situation in which you are too far from your buddy or another diver, have no other alternate air source and are deep enough that you doubt you can reach the surface any other way.
   - You make a buoyant emergency ascent exactly like a controlled emergency swimming ascent, except you ditch your weights and exceed a safe rate.
   - Again, look up and make the ahhhhh sound as you rise.
   - Because you exceed a safe rate, this method has more risk than the other options (which is why it is your last choice), but is obviously better than staying on the bottom without air.
   - As you near the surface, you can flare out your arms and legs to create drag and slow your ascent.

e. After reaching the surface in an out-of-air emergency, make yourself buoyant, but you can't inflate your BCD using the low pressure inflator with an empty cylinder.
   - Inflate the BCD orally, and/or drop your weights.
   - You practice BCD oral inflation during your training dives.

- ***How should you assist an unresponsive diver underwater? What is the priority?***

7. A diver who becomes unresponsive underwater is in a serious emergency situation. Assist an unresponsive diver following these procedures.
   a. The priority is to get the diver to the surface.

- Swim the diver to the surface.
- If necessary, use the victim's BCD and/or drop weights to make the victim buoyant.

b. If the victim's regulator is in the mouth, hold it there. If it is not, don't waste time trying to replace it.

c. Ascend at a safe rate.
   - If the victim's buoyancy becomes too great for a safe ascent rate, let the victim go. Finish a safe ascent and resume the rescue at the surface.
   - Keep yourself safe. You can't help someone else if you have troubles of your own.

d. At the surface, follow the priorities and procedures for an unresponsive diver at the surface previously discussed.

E. First Responder Care for Diving-related Emergencies

- ***What signs and symptoms may be present with a diver who is or was unresponsive?***

1. A diver who is or was unresponsive in water or underwater should be considered a serious medical emergency.
   a. Being unresponsive is being unconscious, or unable to respond or act coherently .
   b. Near drowning (becoming unresponsive underwater), pressure-related injuries and medical conditions not directly related to diving (such as heart attack) can cause these signs (what you observe) and symptoms (what the victim feels):
      - difficulty breathing
      - unconsciousness
      - unclear thinking
      - visual problems
      - paralysis
      - chest pain
      - lowered alertness
      - cardiac and respiratory arrest

- ***What are your priorities when assisting someone who is or was unresponsive?***

2. After removing the diver from the water, your priorities when assisting someone who is or was unresponsive are to
   a. make sure the diver is breathing (by providing rescue breathing and/or CPR if necessary).
   b. contact emergency medical care.
      - Your first contact is usually to the appropriate local emergency medical care.

- If a diver emergency service like DAN (Divers Alert Network) serves the area, contact it next. This service coordinates with local emergency personnel to provide specialized medical guidance for diving accidents, and helps the diver reach specialized medical care.
- You'll learn more about this in Knowledge Development Section Four.

- ***What are the general steps to follow when giving aid to a diver who is or was unresponsive?***

3. Once out of the water, follow these general steps when giving aid to a diver who is or was unresponsive.
   a. Keep the diver's airway open and check for breathing.
   b. Provide CPR as necessary.
      - Do not use abdominal thrusts unless you are unable to provide rescue breathing due to a suspected obstruction.
      - Inhaled water, if present, does not prevent rescue breaths. You don't have to try to clear it in any way.
   c. If the diver is unresponsive but breathing, keep the diver lying level on the diver's left side. This position is not more important than transporting the diver to safety or providing CPR should it become necessary.
   d. Continually monitor the diver's breathing.
   e. If the diver has regained responsiveness, keep the diver lying down comfortably.
   f. Administer emergency oxygen as soon as possible.
   g. Keep the diver still and maintain a normal body temperature by protecting from heat or cold.
   h. Continue to provide care until emergency medical care arrives.
   i. If unable to accompany the diver to medical care, write down as much as background information as possible about the diver and the dive, and attach it to the diver in a conspicuous place.
      - Provide only information relevant to care: e.g., the dive profile, emergency care provided, emergency contact information, any known medical conditions, etc.
      - Write only facts. Do not speculate or guess – bad information is worse than no information.
   j. Any diver who has been unresponsive in or under water requires medical examination, even if the person appears fully recovered.
      - Some conditions, such as near-drowning, can have delayed serious, potentially fatal, consequences hours after the incident.
      - Post-incident medical examination can identify these problems and provide appropriate treatment.

III. Equipment 3

A. Surface Signaling Devices

1. You have already learned that at times, you want to have surface signaling devices to help you attract attention and be visible in the water.

- ***At a minimum, how many surface signaling devices should you have with you on a dive?***

2. Typically, you should have at least two surface signaling devices with you on a dive. Make them a standard part of your scuba kit.
   a. You should have an audible device that allows you to attract attention with sound.
   b. You should have a visual device that makes you easier to see at a distance, especially amid waves.
   c. In an emergency, you may use both – the audible signal to alert help on the boat or shore, and the visual signal so responders can see where you are.

- ***What are types of surface signaling devices do divers commonly use?***

3. Divers commonly use the following devices:
   a. Whistles are the most common audible devices. You commonly attach them to the BCD inflator where they're rapidly accessible but out of the way.
   b. Low pressure horns use air from your cylinder. They are much louder than whistles. They usually attach to the BCD inflator; you probably want a standard whistle, too, to use if your cylinder is empty.
   c. Inflatable signal tubes are bright colored (usually orange) plastic/fabric tubes that you inflate at the surface. They stand more than a metre/three feet above the surface helping make you visible even in rough conditions. They roll up compactly and fit in your pocket when not in use.
   d. Delayed Surface Marker Buoys (DSMBs) do the same job as inflatable signal tubes. The main difference is that you can attach them to a line and reel and deploy them from the bottom as well as at the surface.
   e. Signal mirrors allow you to reflect sunlight to attract attention. Besides signaling boats, you can signal aircraft. They are compact and fit in your pocket.
   f. Signal lights and flashers designed specifically for diving are the best visual signaling devices when night diving. They fit in a pocket, or may strap to an arm or wrist.

B. Dive Floats and Flags

- ***What are five uses for a surface float?***

1. You may use a surface float when diving from shore, or if going some distance from a dive boat. It is any small float that you can use for
   a. resting.
   b. marking a dive site location.
   c. carrying accessories or other items.
   d. assisting another diver.
   e. supporting a dive flag.
2. There are many sizes and styles of surface floats. Tire inner tubes with special covers are one of the most popular types.

- ***How should you carry line used for a surface float?***

3. Depending upon the dive plan and the site, you may tow or anchor the float.
   a. Either way, you will need line (usually nylon or other synthetic appropriate for aquatic use) at least 15 metres/50 feet long.
   b. Carry the line on a reel or line caddy to avoid entanglement. Trying to carry that much line loose can cause entanglement.
   c. Do not attach the float to your gear; tow it by hand. If it gets entangled on something or snagged by a boat, you can simply let go.

- ***Why should you use a dive flag?***

4. Underwater, boaters and other watercraft can't see you. You use a dive flag to alert them that you're there. This reduces the risk of being run over.
   a. In many areas, you are required by law to use a dive flag.
   b. The flag may fly from a dive boat, or from a surface float.

- ***What are the two types of dive flags? Under what conditions should you use each?***

5. There are two recognized dive flags. Where you use each depends upon the circumstances, but you should fly it high enough and it should be big enough to be visible from 100 metres/yards. Both versions usually have a wire extender to make them visible even without wind.
   a. The traditional dive flag is a red rectangle with a white diagonal stripe.
      - This flag indicates there are divers below and boats should keep clear.
      - Many areas require this flag when diving in navigable waters.
   b. The Alpha flag is a blue-white pennant.
      - The flag indicates that the vessel flying it has divers in the water and can't maneuver.
      - This flag is generally only required for boats conducting diving, and is not required on diver-towed floats. But, some areas use it for all diving activities. Your instructor will tell you the practices in your area.

c. Regional regulations and practices stipulate what flag to use.
   - In some situations, you may need to fly both flags.
   - Don't display either flag unless divers are actually in the water.

- ***How close are you supposed to stay to a dive flag, and how far away are boaters supposed to stay from a dive flag?***

6. Local law often regulates how close you must stay to your dive flag and how far boaters must stay away.
   a. If there are no specific laws, the rule of thumb is to stay within 15 metres/50 feet of the flag. Boats should stay at least 30 to 60 metres/100 to 200 feet away.
   b. Don't assume boats know what the flags mean. If a boat sounds like it is close, stay down, deep enough to be safe until it clears the area.
   c. Stay close to the flag. You can't expect boats to avoid you if you are far from it.

IV. Your Skills as a Diver 3

[NOTE: Briefly review the skills student divers will learn during the third confined water dive.]

A. Deep water entry

B. Remove and replace weights at the surface

C. Cramp releases

D. Neutral buoyancy – hovering

E. Fine-tuning trim

E. Air depletion/alternate air source combined exercise

F. Controlled Emergency Swimming Ascent

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Knowledge Development Four

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V. Your Skills as a Diver 4

Outline

I. Equipment 4

A. Mesh Utility Bags

- ***What would you use a mesh utility bag for?***

1. Besides your gear bag, you may want one or more mesh utility bags.
   a. A mesh utility bag is a heavy-duty bag made from mesh (so it drains) nylon or other water resistant synthetic.
   b. Think of these bags as all-purpose containers for bulky or hard to contain items underwater, and for wet items after a dive. Common uses include:
      - Holding litter during an underwater cleanup
      - Carrying multiple small accessories that are difficult to pocket easily
      - Transporting a wet exposure suit after a dive

- ***What options can you choose from when choosing mesh utility bags?***

2. Because they're used for many purposes, you can choose from different options.
   a. Style – Some are all mesh with a draw string for closure, while others have wire frame mouths that allow you to hold them open with one hand; the frames also lock closed.
   b. Material – Many mesh utility bags are entirely mesh; others have an upper portion that is solid to improve durability.
   c. Size – Mesh bags range from just big enough for your hand to large enough to hold almost all your gear. Choose the size for the job you have in mind.
   d. Straps, handles – Larger mesh bags, especially those intended for carrying wet gear, usually have handles and straps.

- ***Why should you be cautious about attaching a mesh utility bag to your gear while diving?***

3. Be cautious about attaching a mesh utility bag to your gear while diving.
   a. It is important that you can quickly discard anything that may weigh you down or add a lot of drag in an emergency. You also don't want to create potential entanglement/snagging problems.
   b. There's not usually an issue with a rolled up and stowed mesh utility bag, nor a small bag with only lightweight contents.
   c. Carry a large, loaded bag (e.g., filled with trash during a cleanup dive) rather than attach it. That way, you can simply let go of it in an emergency.
   d. Hand-carry a large bag that's unstowed, so you can release it if it tangles or snags on something.

B. Slates and Wet Books

- ***For what four purposes might you carry a slate or wet book?***

1. It is recommended that you carry a slate or wet book that you can write on during a dive for several purposes.
    a. Communication – You can use signals most of the time, but sometimes it's more effective to write down what you're trying to tell your buddy.
    b. Limits and backup information – Many divers like to note the dive plan limits for reference rather than rely on memory. The more complex the dive, the more helpful this can be.
    c. Recording dive information – Similarly, it can be useful to write down information during a dive, such as where you find something you want to revisit, how much air you used to reach a site, etc.
    d. The unexpected – You don't always know that you'll need to write something down until the moment arrives. Make a slate or wet book a standard part of your kit and you're always prepared for it.

- ***What options can you choose from when choosing slates and wet books?***

2. You can choose from these options when selecting slates and wet books:
    a. A slate is a piece of rigid plastic upon which you write with an attached pencil or marker. Its main advantage is that it is reusable (you erase it after the dive).
    b. A wet book is a compact notebook with waterproof pages that you also write on with an attached pencil. You don't reuse wet book pages – you remove them, so you have to replace wet books from time to time. Its main advantages are that you have much more writing space, and the pages can be kept (e.g., you can put a site sketch in your logbook).
    c. Slates come in many different sizes – a larger slate offers more writing room, but is harder to stow. Choose one that fits easily in one of your pockets.
    d. Most wet books are about the same size (around 20 cm/8 in X 10 cm/4 in). They flex and fit comfortably in your exposure suit thigh pocket.

C. Dive Lights

- ***What do you use a dive light for? Why might you use one during the day?***

1. Dive lights are lights designed specifically to be both watertight and to withstand pressure for diving.
2. As a recreational diver, there are two main uses for a dive light.
    a. Night diving – In the PADI Advanced Open Water Diver and Night Diver courses, you learn to dive after sunset. Obviously, you need a dive light (two, actually) so you can see in the dark.

b. Day diving – Many divers like to carry a compact light so they can look into holes and cracks on the reef where shy organisms hide.

- ***What options can you choose from when selecting dive lights?***

3. Your main choices in choosing dive lights are size, brightness and power source.
   a. Size and brightness – There's a trade between brightness and the beam width, and size.
      - Compact lights stow easily, making them good choices for day use, and as spare lights when night diving. But, they are not as powerful and have narrower beams.
      - Larger lights are brighter and cover a wider area, but don't stow as easily. Use these as your main light when night diving.
      - There are specialized lights used in technical diving, lighting underwater video, etc. Your dive retailer can provide guidance about these as appropriate.
      - As technology advances, size versus brightness/beam width is becoming less and less of an issue. Modern LED lights are making powerful, wide beam lights available in smaller packages. Today's "large" lights are smaller than many of the "compact" dive lights available 10 years ago.
   b. Power source – You can choose to use rechargeable or disposable batteries.
      - Larger, more powerful lights usually have dedicated rechargeable battery systems, though many use disposables. Compact lights usually take disposables, with AA cells the most common.
      - You can use rechargeable NiMH AAs in most newer lights that take disposable AAs (check the manufacturer literature to be sure), giving you the choice with the same light.
4. Accessories for your light.
   a. You don't want to lose your light, so most divers mount a clip on it to secure it when not in use.
   b. Especially for larger lights, a wrist lanyard helps avoid loss, plus allows you to release the light without losing it.

D. Log Books and eLogs

- ***Why do you log your dives?***

1. As part of your diver training, your instructor has you log your dives and signs your log. This is important for validating the training you receive. It's recommended that you continue your log after you're certified, for several reasons.
   a. Reference – Logged dives provide information to make planning subsequent dives easier. You can reference notes about dive sites, as well as your equipment; e.g., if it has been a while since you wore a

dry suit in fresh water, you can check your logbook to see how much weight you used instead of having to figure it out from scratch.

b. Documentation – As you grow as a diver, upper training levels often require documentation of making certain types and numbers of dives. Your log provides this record.

c. Onsite experience reference – Some dive operators want to know where you've been diving, how often and so on, so they can serve you better with the diving they offer. It's easier to provide complete information with a log.

d. To share – At ScubaEarth and in other online communities, divers inform each other about dive sites. Posting your logged information helps other divers, and their information helps you.

e. Related information – Besides recording your dives, use your log to keep other information you may want when diving:
   - Local emergency contact information for sites you dive frequently.
   - Phone numbers and websites for dive buddies, gear manufacturers, dive resorts, your instructor, etc.
   - GPS coordinates/addresses for dive boats or shore dive sites.
   - Equipment serial numbers and service dates.

- ***What options can you choose from when selecting a dive log? What information do you typically record, at a minimum, regardless of which you choose?***

2. Your primary choices with a log are paper logbooks and electronic logs (eLogs).

   a. Paper logs range in size, and in the information you record.
      - Compare different log pages for blank space, check boxes, etc.
      - Popular logs have special pages for logging training dives separately or distinctly from nontraining dives.
      - Choose a log that matches how you think you'll use it – if you like to write lots of details, choose a log with large pages and lots of blank writing space. If you're more minimalist, a smaller log with check boxes and fill in blanks may be more your style.

   b. eLogs have become more popular with the rise of electronics. There are many types available, most of which use click boxes and a few type-in fields.
      - Tablet computers have eLog apps available.
      - Some dive computers have dedicated software that allows you to download dive information. With these, you may only need to enter the dive site and interest notes – the dive data upload automatically.

   c. Because it is so easy to use most eLogs, and you can typically print out entries, some divers keep both eLogs and paper logs.

d. Most logs prompt you to record more, but it is recommended that at a minimum, you log the:
    - Date
    - Dive site (name or location)
    - Dive buddy
    - Dive depth and duration
    - Objective/description

E. Dive Planning Software

- ***What can you do with dive planning software?***

1. One option for planning dives is to use a computer app or software program. This is common practice in technical diving, but as a recreational diver, there are two common uses.
    a. The first is to estimate how long your air supply will last on a dive.
    b. The second is the time your dive computer will allow on a dive, which is based on how much nitrogen your body absorbs (you will learn more about nitrogen absorption and computer limits later in this section).

- ***What options do you have with dive planning software?***

2. You can choose dive planning software for desktop/laptop computers, though tablet apps are the most popular.
    a. Some software that interfaces with dive computers has a planning function (and may have an eLog function, too).
    b. You can choose from very basic software intended only for planning recreational dives, as well as software intended for much more complex diving.

F. Spare Parts Kit

- ***Why is it important to have a spare parts kit?***

1. You can miss a dive simply because you lose an o-ring or break a strap. For this reason it is important to have a spare parts kit (some call it a save-a-dive kit).
    a. A spare parts kit is simply a collection of user-replaceable items in a compact, sturdy box.
    b. Keep the kit in your gear bag so you're always prepared.

- ***What items might you have in a spare parts kit?***

2. A typical spare parts kit might have these items:
    a. Spare mask strap, fin strap and snorkel keeper (Tip: The Velcro™-type mask straps make good spares because they're easy to put in place and fit almost any mask.)
    b. Harness/weight belt buckle

c. Pull ties
d. Adjustable wrench (spanner), pliers, screw drivers, hex wrenches (allen keys) or scuba tool
e. Regulator mouthpiece
f. Accessory clip
g. Slate/wet book pencil
h. Various sized cylinder valve/DIN valve o-rings
i. Cement appropriate for exposure suit repair
j. Sunscreen and spare sunglasses (not really dive parts, but can come in handy)

3. Tip: Choose a storage box somewhat larger than you actually need. With experience, you tend to add to it, so you'll want room to grow. Just be cautious to keep it small and efficient by avoiding a lot of items you don't actually use.

II. Being a Diver 4

A. Your Health and Fitness

1. Diving is relaxing and you try to dive relaxed, but it is not sedate and you need to be in good health and reasonable fitness.
2. Strenuous activity can arise, including handling gear, currents, an emergency or unanticipated physical demands. Being in good health helps assure you can meet these demands so you dive safely.

- ***What general recommendations apply to your fitness as a diver?***
- ***How often is it recommended that you have a complete physical examination for diving?***

3. Follow the general recommendations that apply to your health and fitness as a diver.
   a. Maintain a reasonable degree of physical fitness.
      - This means that you have adequate fitness, plus a physical reserve, for the type of diving you do.
      - Participate in a regular exercise program (see your physician before starting one, however).
      - You don't have to be a professional athlete – just in good average health.
   b. Keep your immunizations current, especially tetanus and typhoid.
   c. Eat a well-balanced diet and get adequate rest, especially before diving.
   d. It's a good idea to have a physical examination when you start diving, and regularly thereafter.
      - Ideally, have a physician knowledgeable in dive medicine conduct the examination.

- However, the RSTC Medical Statement provides guidelines developed by the dive medical community that any physician can use to conduct dive physicals. Your instructor can provide you with this form, or you can download it from padi.com.

- ***What factors in diving can strain your heart and cardiovascular system?***
- ***What should you do as a diver if you are or may be predisposed to heart disease?***

4. Like any activity that can cause physical exertion and stress, diving can strain your heart and cardiovascular system.
   a. Factors that can do this include exertion from swimming hard, carrying equipment, climbing a ladder, long walks wearing gear, and heat stress from wearing an exposure suit in a hot climate.
   b. These factors can cause heart attack in predisposed individuals. They can also be issues for other cardiovascular conditions.
   c. If you have or may have risk factors that predispose you to heart disease due to your age, life style, body composition, family history or any other factors, be sure to discuss how to address them with your physician. Your doctor can help you assess the risk, and how you can manage that risk as a diver.

- ***What are the two most common substances that you should refrain from using before diving, and why?***

5. Never use alcohol or tobacco prior to diving.
   a. Alcohol affects your judgment, and its effects may increase with depth.
      - Alcohol accelerates body heat loss, which can be an issue on cooler dives.
      - Be moderate if drinking the night before diving because it tends to dehydrate you, which some physiologists think can contribute to decompression sickness risk.
   b. Smoking is undeniably detrimental to your health, and not a good choice for anyone, but particularly if you live an active lifestyle.
      - If you do smoke, abstain for several hours prior to and after diving, because it significantly decreases the efficiency of your circulatory and respiratory systems.
      - Smoking theoretically raises the risk of lung overexpansion injury by causing air trapping within your lungs – even when you breathe normally.
      - Nonsmoking tobacco use, including e-cigarettes seem to pose less immediate risk, though abstaining is still recommended, because you still consume nicotine.

- ***What are the recommendations for using prescribed or over-the-counter medications before diving?***

6. Drugs can create problems when diving, so use prescription drugs and over-the-counter medications with caution.
    a. Any drug that affects your judgment, thinking and/or reactions should generally not be used before diving.
    b. Other effects may create problems, though many drugs have no effects that interfere with diving. If unsure consult your physician about a particular drug prior to diving. If still in doubt, don't dive until you no longer use the medication.

- ***What effect does menstruation have on diving?***
- ***Why is it recommended that pregnant women not dive?***

7. If you're a woman, you may wonder if menstruation and pregnancy are issues when diving.
    a. If menstruation doesn't normally keep you from participating in other active recreations, it's not likely to affect diving either.
    b. It is recommended that pregnant women not dive.
        - This isn't because of a known risk, but rather because there's not enough known about how diving could affect a developing fetus.
        - It is generally agreed that it's not worth the risk, and you should discontinue diving while pregnant or trying to become pregnant.

- ***What should you do if you feel ill before a dive?***

8. If you feel ill before a dive, cancel the dive.
    a. You want to be in good physical and mental health when diving so you can avoid problems and handle them if they occur.
    b. As you learned in Section One, even a cold can cause problems by trapping air, making it difficult to equalize and in some cases, risking lung overexpansion injuries.
    c. Don't use medication to eliminate symptoms just so you can dive while unhealthy. Get well, then resume diving.

B. Staying Current and Active as a Diver

- ***How do you keep your dive skills and knowledge current and refreshed?***

1. Your dive skills and knowledge stay sharp if you use them frequently. Like any specialized set of skills and knowledge, they erode if you go an extended period without diving.
    a. The best way to keep your knowledge and skills current and refreshed is to use them – dive regularly. If you can't get to open water, scuba dive in a pool with a buddy to keep your skills polished.
        - The PADI Skill Practice and Dive Planning Slate lists the water skills you learn in the PADI Open Water Diver course, and

prompts you to self-assess whether you're comfortable with each skill, or want more practice.

b. Besides going diving, involve yourself with the dive community in person (on dive outings, as part of a club, etc.) and online (social sites, forums). Interacting with other divers helps you keep up with current practices and trends.

c. Visit dive websites and subscribe to dive magazines regularly to keep up with new recommendations, gear, travel destinations and the like.

- ***How do you refresh your dive skills and knowledge after a period of inactivity? As a new PADI Open Water Diver, after what interval of inactivity is this recommended?***

2. Although the ideal is to dive regularly, periods of inactivity are a normal part of most divers' lives.

   a. After an extended period without diving, it is recommended that you refresh your knowledge and skills. Your instructor can do this with the PADI Scuba Review program (usually takes less than a day and you can do the knowledge review portion online with PADI eLearning).

   b. As a PADI Open Water Diver, it is recommended that you refresh your knowledge and skills if it has been six months or longer since your last dive.

- ***How does continuing your diver training help keep your skills refreshed?***

3. One of the best ways to keep your skills refreshed is to continue your diver training.

   a. In the PADI Adventures in Diving program, you learn new skills and expand your capabilities, but you use your existing skills as well.

   b. This is true of most PADI specialties and upper level courses.

   c. Because you usually also make new friends, visit new dive sites and expand the types of diving you can do, continuing your training increases your opportunities to dive. All these make it easier to dive regularly apart from training.

C. The Air You Breathe

- ***What component gases make up air?***

- ***For practical purposes, what percent of each of the component gases does air consist of?***

1. As you've learned, as a recreational diver underwater you breathe air. Other than being specially filtered for scuba uses, it is the same as the air you're breathing now.

2. For many purposes, we can treat air as a single gas, but it is actually a mix of several gases.

a. The component gases, in order of abundance, are nitrogen, oxygen and more than a dozen trace gases.
b. Trace gases make up less than one percent of air, so for practical purposes, air consists of:
   - 79 percent nitrogen
   - 21 percent oxygen

- ***To what four diving related issues does the makeup of air relate?***

3. Air can be considered a single gas with respect to the depth-pressure-volume-density relationships you learned in Section One.
   a. As you recall, these relationships explain (among other things) why you need to equalize, why you use more air the deeper you dive, buoyancy changes as you change depth, and why you must breathe continuously, never holding your breath, to avoid lung overexpansion injuries.
   b. There are four issues in diving that relate to the component gases in air:
      - Oxygen toxicity
      - Contaminated air
      - Decompression sickness
      - Gas narcosis
   c. We'll look at oxygen toxicity, contaminated air and decompression sickness in this section. We'll look at gas narcosis in Knowledge Development Five.

- ***How does using enriched air nitrox affect the component gases that make up air?***

4. Many PADI Open Water Divers qualify to use EANx (enriched air nitrox) by taking the PADI Enriched Air Diver course shortly after completing this course, and, at your instructor's discretion, you can start learning to use EANx during the PADI Open Water Diver course (ask your instructor for details).
   a. EANx has the same component gases as air, but the proportions differ.
   b. EANx is any blend of oxygen and nitrogen with 22 percent or more oxygen (balance nitrogen).
      - Common blends in recreational diving are 32 percent and 36 percent oxygen.
      - Tec divers use EANx with even higher proportions of oxygen.
   c. As you will see, increasing the oxygen content and decreasing the nitrogen content has advantages and disadvantages with respect to oxygen toxicity and decompression sickness.

D. Oxygen Issues

- ***How do you prevent problems with oxygen when diving with air?***

  1. Although we need oxygen to live, under high pressure, oxygen is toxic.
     a. If a gas has oxygen in it, oxygen toxicity can result from breathing it deeper than a specific depth. The higher the oxygen content, the shallower the limit for using it while diving.
     b. High oxygen percentages can also create some fire/combustion risks with respect to the equipment with which it must be used.
     c. Fortunately, neither of these are meaningful issues when breathing air within recreational depth limits.
        - To avoid oxygen toxicity when diving with air, don't exceed the maximum depth for recreational diving (40 metres/130 feet).
        - Fire/combustion problems aren't issues using air with standard scuba equipment.

- ***Why shouldn't you dive with a cylinder labeled "oxygen" or known to be filled with 100 percent oxygen?***

- ***Why is it important to be trained as a PADI Enriched Air Diver, or under the supervision of a PADI Enriched Air Instructor, before attempting to dive with enriched air?***

  2. If a diver uses a breathing gas with more than 21 percent oxygen, then the oxygen in it can be toxic at shallower depths.
     a. The limit for pure (100 percent) oxygen is only 6 metres/20 feet. It is toxic deeper than this depth.
        - Recreational divers don't use 100 percent oxygen, but tec divers often do (shallower than 6 metres/20 feet, as part of their ascent procedures). They are trained to do this, and also use equipment that is oxygen service rated when they do.
        - As a recreational diver, never dive with a scuba cylinder labeled "oxygen" – only properly trained tec divers use these.
        - Rebreathers have small cylinders (you would not confuse these for regular scuba cylinders) with oxygen, but this oxygen mixes with air so the diver doesn't breathe pure oxygen. You can learn more about this technology in the PADI Rebreather Diver course.
     b. As you learned earlier, enriched air (EANx) has more than 21 percent oxygen.
        - To avoid oxygen toxicity, the maximum depth at which you use enriched air is shallower than with air. How much shallower depends upon how much oxygen the enriched air has.
        - Enriched air also has some equipment-related concerns associated with the higher oxygen content.
        - It isn't difficult to avoid oxygen toxicity and equipment-related problems, but it's important to learn how to do so in the PADI

Enriched Air Diver course, or to be under the supervision of a PADI Enriched Air Instructor, before diving with enriched air.

- Never dive with a cylinder labeled "Nitrox," "EANx" or "Enriched Air Nitrox" unless you're certified as an Enriched Air Diver or under the supervision of a PADI Enriched Air Instructor.

E. Contaminated Air

- ***What are some possible causes of contaminated air?***

1. Contaminated air is air that contains unintended impurities. Such contaminants are common substances like carbon monoxide and oil vapor.
   a. Contaminated air is actually very rare; compressors for filling scuba cylinders use special filters and separators to keep contaminants out of breathing air.
   b. Scuba air must be especially pure because trace contaminants that might be harmless at the surface can be toxic when breathed under pressure.
   c. Possible causes of contaminated air include:
      - Getting a cylinder filled at an improper source (i.e., some place other than a professional dive center, resort or dive boat).
      - Improper maintenance of the filling system.
      - Very high levels of a contaminant in the source gas – overwhelms the filters.

- ***What are five possible signs/symptoms of contaminated air?***

2. Contaminated air may smell and taste bad, but sometimes a contaminant can be odorless and tasteless. A diver breathing contaminated air may have these signs/symptoms:
   a. Headache
   b. Nausea
   c. Dizziness
   d. Unconsciousness/unresponsiveness
   e. Cherry-red lips/fingernail beds (though this is difficult to see underwater)

- ***What should you do for a diver who you suspect breathed contaminated air?***

3. If a diver is suspected of breathing contaminated air:
   a. Have the person breathe fresh air. Administer emergency oxygen if available.
   b. Provide rescue breathing and CPR if required.
   c. Contact emergency medical care. The diver should have medical attention in all cases.

- ***How do you avoid contaminated air problems?***

4. It is easy to avoid contaminated air by getting your cylinder filled at reputable scuba air sources – namely, professional dive operators.
    a. Professional dive operators know how serious air quality is (they usually use it themselves!). They take care of their fill systems and have their air quality tested frequently.
    b. Never have a scuba cylinder filled from a compressor that is not intended for breathing air. E.g., you would not use a compressor intended for sand blasting.
    c. Regardless of where you have it filled, if air tastes or smells bad, don't use it.
    d. If you feel ill or get a headache during a dive, end the dive immediately. If you have cause to suspect the air, have it tested immediately.
    e. Some divers check their air with inexpensive carbon monoxide testers.
    f. Another way to suffer the effects of contaminated air poisoning is by breathing the exhaust fumes aboard a boat. Stay out of a boat's exhaust and in the fresh air.

F. Decompression Sickness

- ***What two primary factors influence how much nitrogen dissolves into your body tissue during a dive?***

1. As you've learned, your time underwater has limits beyond how long your air lasts, how warm you are or whether you're tired. These limits relate to nitrogen gas that is in solution in your body.
    a. During a dive, the increased pressure causes nitrogen from your breathing air to be absorbed, dissolving into your body tissues.
    b. The greater the pressure, the faster nitrogen dissolves into your tissues.
    c. The longer you're underwater, the more time you give for nitrogen to dissolve into your tissues.
    d. Therefore, the two primary factors that influence how much nitrogen you absorb during a dive are depth (pressure) and time.

- ***What condition can result if you exceed established depth and time limits while diving and then surface? What happens in the body that causes this condition?***

- ***What are nine signs/symptoms of decompression sickness? How soon do they occur after a dive?***

2. Your tissues don't use the nitrogen you absorb, so when you ascend and reduce the pressure, there is more nitrogen than can remain dissolved in your tissues. The excess nitrogen therefore dissolves out of your tissues.

Normal blood circulation carries the excess nitrogen to your lungs, which exits as you exhale.

a. If the amount of excess nitrogen is within accepted limits, your body normally eliminates the nitrogen harmlessly over the next several hours.
   - You use your dive computer (or dive tables as the RDP or eRDPML) to stay within accepted nitrogen limits. You'll learn about doing this later in this section.
   - You'll also learn more about practices like safety stops that help you keep nitrogen levels within accepted limits.

b. If the amount of excess nitrogen is too high, when you ascend and surface the nitrogen may come out of solution faster than your body can eliminate it.
   - This can cause nitrogen bubbles to form within your blood and tissues, much as bubbles form when you open a soda bottle and release the pressure.
   - Bubbles forming in the body cause a very serious medical condition called decompression sickness (DCS for short). It is sometimes called "the bends."

c. The signs and symptoms of DCS depend upon where bubbles form in the body. They include:
   - Paralysis
   - Shock
   - Weakness and prolonged fatigue
   - Dizziness
   - Numbness
   - Tingling
   - Difficulty breathing
   - Joint and limb pain
   - In severe cases, unconsciousness and death

d. DCS signs and symptoms may be pronounced and obvious, but they may also be subtle, like a mild to moderate dull ache (often but not necessarily in the joints), mild to moderate tingling or numbness, weakness and prolonged fatigue.

e. DCS signs and symptoms usually occur 15 minutes to 12 hours after a dive, though they can occur before surfacing and they can occur after 12 hours.
   - Signs and symptoms may persist or be intermittent.
   - Treat all cases of suspected DCS as serious, no matter how serious or mild the signs/symptoms appear to be.

- ***Besides dive time and depth, what nine secondary factors are thought to influence how the body absorbs and releases dissolved nitrogen?***

3. Although time and depth are the primary variables that determine whether bubbles will form in the body and cause decompression sickness, other factors influence how your body absorbs and releases excess nitrogen.
    a. Physiologists think that when present, the following secondary factors can contribute to developing DCS:
        - Fatigue
        - Dehydration
        - Vigorous exercise before, during or immediately after the dive
        - Cold
        - Poor fitness/high bodyfat
        - Illness
        - Injuries
        - Alcohol consumption before or after a dive
        - Age
    b. As you'll learn in Knowledge Development Five, exposure to altitude (by flying, or driving through mountains) after diving can contribute to getting DCS.
    c. Knowledge Development Five discusses the first aid and treatment for DCS.

III. Using Dive Computers and Tables 1

A. How Dive Computers and Tables Work

- ***How does a dive computer or dive table estimate the amount of nitrogen you absorb during a dive?***

1. You've learned that to avoid decompression sickness, you have to keep body nitrogen levels within accepted limits that it can tolerate without forming bubbles.
    a. At present, there is no way, during a dive, to measure the actual nitrogen absorbed by your body.
    b. To reduce DCS risk, physiologists and scientists created mathematical decompression models to estimate the theoretical changes in nitrogen in your body before, during and after a dive.
    c. As a diver, you apply these models by using a dive computer or dive tables like the Recreational Dive Planner (table or eRDPML electronic table version).
    d. Dive computers and dive tables work by using time and depth information from your dives to determine the theoretical amount of nitrogen in your body. They compare this estimate against limits that were derived from experimental dives and human experience.

- Dive computers measure depth and time throughout a dive (and after – more about this shortly) and apply the information to the decompression model electronically. A computer constantly updates the theoretical nitrogen in your body based on your dive depths and time, and compares it to the model. Dive computers have become the most common method of determining decompression information.
- Before dive computers, divers used dive tables. With the RDP Table, you use the depth from a depth gauge and the time from a timer or watch to look up limit information on a table.
- The eRDPML is a calculator-format electronic dive table. You enter your depth/time information and it looks it up on the table for you.

- ***Does a dive computer or dive table directly assess anything going on inside a diver's body?***

- ***Why can no dive computer or table guarantee that decompression sickness will never occur, even within its limits? How do you address this concern?***

2. Dive computers and dive tables do not directly access anything going on inside a diver's body. They apply a mathematical decompression model that works for the vast majority of people most of the time.
   a. Decompression models are highly reliable, but they cannot account for individual variations in physiology, such as the secondary factors you learned in the last subsection.
   b. Because people vary in their susceptibility to decompression sickness, no dive computer or dive table can guarantee that decompression sickness will never occur, even though you dive within its limits.
      - You must accept that there is always some risk of DCS when you go diving.
   c. Although dive computers and tables cannot account for individual variation, as a diver you can help further reduce risk by always following conservative dive practices.
      - Always dive well within the limits of your dive computer or table. The more of the predisposing factors that apply to you, the more conservative you want to be.
      - Ascend slowly from every dive (18 metres/60 feet per minute, or slower as required by your computer) and make a three minute safety stop at 5 metres/15 feet (more about how ascent rates and how stops apply shortly).

B. No Stop Diving

- ***What is no stop (no decompression) diving?***
- ***What is a no stop (no decompression) limit?***
- ***What do you have to do if you exceed a no stop limit?***

1. As a recreational diver, you plan your dive so that you can, if necessary, swim directly to the surface without unacceptable risk of decompression sickness.
    a. This is called no stop diving. (You sometimes hear it called "no decompression diving," but "no stop diving" has become preferred because it is more technically accurate.)
    b. You plan your dives so they are always well within the no stop limits.
        - A no stop limit is the maximum time you can spend at a given depth and still ascend directly to the surface.
        - If you exceed a no stop limit, to keep DCS risk within accepted limits, you must make one or more decompression stops. These are stops at specific depths for prescribed times to allow your body to release dissolved nitrogen before you ascend further.
        - In recreational diving, decompression stops are emergency procedures only (you'll learn more about these in Knowledge Development Five).
        - You sometimes hear no stop limits called no decompression limits (NDLs).

- ***What is the relationship between depth and your no stop limits?***

2. As you've learned, the deeper you dive, the greater the pressure on your body. The greater the pressure, the faster nitrogen dissolves into your tissues. This means the deeper you dive, the shorter your no stop limits.
    a. You can see the no stop limits for each depth in the Dive Plan Mode of your dive computer.
        - With most computers, you scroll depths in 3 metre/10 foot increments, displaying the maximum time allowed at each depth. You use this information to help plan your dive.
        - Dive computers may have different decompression models. As a result, the no stop times for two different model computers may differ somewhat.
        - You can similarly find no stop times on the RDP Table and eRDPML.
    b. You can see the relationship between depth and no stop time by comparing them. The times/depths shown are from the RDP Table, and are similar to many dive computers. Your computer may scroll in different depth increments, but the relationship is similar.

Depth (metres)	No Stop Time (minutes)
10	219
12	147
14	98
16	72
18	56
20	45
22	37
25	29
30	20
35	14
40	9

Depth (feet)	No Stop Time (minutes)
35	205
40	140
50	80
60	55
70	40
80	30
90	25
100	20
110	16
120	13
130	10

c. Note that your no stop time decreases significantly faster as your depth increases.
   - Recall that you also use your air faster as you go deeper. Therefore, the deeper you dive, the more frequently you should check your remaining air supply and your remaining no stop time (more about this shortly).

     Example: You and your buddy descend to 10 metres/30 feet, pause for a moment and then continue to 18 metres/60 feet. At 10 metres/30 feet, your computer would show you have more than three hours no stop time. When you arrive at 18 metres/60 feet, your computer now reads less than one hour no stop time remaining.

d. During the dive, your computer constantly updates your remaining no stop time based on your dive profile – your actual depths, and your times at each depth – and the limits imposed by the decompression model.

- ***What happens to your no stop limits as you ascend to a shallower depth during a dive?***

3. The no stop time you see when you scroll your computer when you're planning your dive is the time you would have if you stayed at the depth the entire dive.
    a. Very commonly, however, you don't stay at the deepest depth the entire dive. You descend to a deepest point and then gradually ascend as you explore and tour along a sloping reef or bottom.
    b. During the dive, your computer shows the no stop time you have remaining at your present depth. As you ascend, nitrogen absorption slows, so the remaining no stop time will increase.
        - The remaining no stop time will, however, be less than you saw for that same depth during the predive scroll because you have absorbed nitrogen.
    c. One of the advantages of dive computers is the ability to calculate more no stop dive time as you as ascend. This is called multilevel diving.
        - With dive tables, you must treat the dive as if you spend the entire dive at your deepest depth. This means you're limited to the no stop time of your deepest depth, even if you actually spend most of the dive shallower.
        - An exception is the eRDPML. Although not as versatile as a dive computer, the eRDPML allows you to plan multilevel dives that increase your no stop time as you ascend.
    d. Here's an example of the changing no stop times you might see on a typical dive: You and your buddy plan to descend on a reef to 18 metres/60 feet, explore a bit, then gradually ascend following the reef upward to shallower depths. You plan to keep the dive well within no stop times, and plan your air use so you will surface with 50 bar/500 psi.
        - For planning purposes, you scroll your computer and find that at 18 metres/60 feet, the no stop time is 55 minutes. You and your buddy agree to start up after 30 minutes if you have not already turned due to air use.
        - You notice that the no stop time for 12 metres/40 feet is 140 minutes.
        - The dive goes as planned. After exploring the reef for 30 minutes at 18 metres/60 feet, you and your buddy follow the reef upward. Just before you start up, your computer shows your remaining no stop time is 25 minutes.
        - As you ascend, the remaining no stop time increases. At 12 metres/40 feet, you see it showing a remaining no stop time of 83 minutes. This is much more time than what you had remaining at 18 metres/60 feet, but less than the no stop time you noted

predive. This reflects the nitrogen absorbed during your 30 minutes at 18 metres/60 feet.

- At this point, you have more no stop time available than the length of time your air supply will last. The dive will then need to end based on your air supply. At the appropriate point, you and your buddy ascend, make a safety stop and surface with 50 bar/500 psi in your cylinders based on your air supply, as you already learned.

- ***Why is your ascent rate an important part of a no stop dive?***

4. Most computers and dive tables have a prescribed ascent rate.
   a. Your ascent rate may be part of the calculations. The no stop time assumes that you ascend at that rate. If you exceed that rate, you may increase your risk of DCS.
   b. Ascending no faster than 18 metres/60 feet per minute, or the ascent rate of your computer (whichever is slower) also helps reduce the chance of lung overexpansion injury.
   c. Most computers have audible and/or visual warnings if you exceed the indicated rate.

- ***What is the difference between a decompression stop and a safety stop?***

5. You've already learned that as you ascend from a dive, it is a good habit to make a safety stop for three minutes at 5 metres/15 feet before finishing the ascent and surfacing.
   a. A safety stop is not required to be within the limits of your dive computer or table's decompression model. You make the stop as a prudent, conservative diver to remain well within your dive computer or table limits.
      - Some problems, such as an out-of-air situation, may call for omitting the stop to reach the surface directly.
      - A few computers and tables have a "required" safety stop. You are still within the decompression model limits, but because you are nearing the limits, calling it a "required" safety stop puts more emphasis on being conservative.
   b. As mentioned before, a decompression stop is a stop in your ascent that is required because you exceeded the no stop limits.
      - If you surface without making a decompression stop, you would be outside model limits.
      - In recreational diving, making a dive with required decompression stops is an emergency procedure only.

C. Repetitive Diving

- ***What is residual nitrogen? What is a repetitive dive?***
- ***How does residual nitrogen affect the no stop limits on a repetitive dive?***

1. If you scroll your computer's no stop times after you've made a dive, you'll see that the times are shorter than they were before the dive.
   a. This is because after a dive, you still have excess nitrogen dissolved in your tissues.
   b. It takes quite a few hours after surfacing for all the excess nitrogen to dissolve out of your body. In theory, it can take longer than a day.
   c. The nitrogen left in your body after a dive is called residual nitrogen.
      - Residual nitrogen is important, because it shortens your no stop limits.
      - A dive made while you still have residual nitrogen is called a repetitive dive. When you make a repetitive dive, your dive computer gives you shorter no stop times to account for the nitrogen still in your body.
      - If you remain at the surface long enough (usually 12 hours or more) for your body nitrogen levels to return to normal, the next dive is no longer considered a repetitive dive. You'll hear it called a "first" dive or a "clean" dive.

- ***What is a surface interval?***
- ***What happens to the dissolved nitrogen in your body during a surface interval?***

2. A surface interval is the time you spend at the surface between two dives.
   a. During a surface interval, the residual nitrogen in your body declines as it dissolves out of your tissues and leaves your body.
   b. This means that the longer your surface interval is, the more no stop time you have on a repetitive dive, all else being the same.
   c. And, as just stated, if your surface interval is long enough (12 or more hours), residual nitrogen is zero (for practical purposes), so the next dive is a first dive.

- ***How does your dive computer calculate repetitive dives?***
- ***Why is it important that you dive with the same computer on every dive you make on a given day and not turn your computer off between dives?***

3. Your dive computer calculates repetitive dives the same way it calculates your first dive.
   a. Starting with the first dive, your computer tracks your depths and times. During the dive, it tells you your remaining no stop time at your current depth, as previously discussed.

b. After the dive, your computer continues to calculate. It "remembers" your residual nitrogen from the first dive. It calculates your time at the surface and how much theoretical residual nitrogen dissolves out of your body.
    - If you scroll your no stop limits periodically as you and your buddies relax during a surface interval, you will see them gradually lengthen as you spend time on the surface.

c. When you dive again, your computer "knows" the theoretical residual nitrogen remaining in your tissues.
    - Your computer shortens your no stop times to account for it.
    - You will notice that at each depth, you have less no stop time than you did on your first dive.
    - An important point is that a dive that is limited by your air supply as a first dive may be limited by your no stop time as a repetitive dive.

d. Because your dive computer tracks your personal theoretical nitrogen levels continuously during all your dives and all your surface intervals, you must use the same computer the entire diving day, on all dives, and not share it with another diver.
    - This is necessary to provide appropriate no stop times over multiple dives and surface intervals.
    - Do not make a repetitive dive without the same computer you used on your previous dive or dives. If you were to use a different computer, it wouldn't have your previous dive information and your no stop times would be inaccurate. This could significantly increase the risk of decompression sickness.
    - Do not share computers with another diver. Dive computers calculate very precisely, so each diver needs a personal computer.

4. Your dive computer continues to calculate the theoretical nitrogen in your tissues until your surface interval is long enough that nitrogen levels return to normal (for practical purposes).

a. Never turn off your dive computer (or remove the batteries), because it may lose all your repetitive dive information. This would make repetitive dive calculations inaccurate.
    - Most modern computers won't let you turn them off for this reason, but some older models did.
    - Your computer may go to "sleep" to save power during a long surface interval, but it is still calculating.
    - Most modern computers won't let you start diving with them if the battery power is too low. See the manufacturer literature/website and/or your instructor about powering off, sleep mode and battery replacement for your computer should it be necessary (batteries usually last a year or more).

b. When your computer calculates nitrogen levels have returned to normal, it will turn itself off or go to sleep.
    - Many dive computers – particular those that are also watches – never turn off or go to sleep. This is normal.
    - Follow any additional manufacturer recommendations regarding the use of a computer for repetitive diving. See your instructor if you have questions about the particulars for your dive computer.

- ***How do dive tables address repetitive diving?***

5. The RDP and other dive tables address repetitive diving by using three tables.
    a. The first table assigns a Pressure Group (designated as a letter) that represents the theoretical amount of residual nitrogen from your dive time and depth.
    b. The second table accounts for nitrogen leaving your body during a surface interval. Taking the Pressure Group from the previous table, it assigns a new Pressure Group based on your surface interval time. This Pressure Group represents having less theoretical residual nitrogen in the body.
    c. The third table shows you no stop times for each depth adjusted for your Pressure Group at the start of the dive.
    d. The eRDPML uses these tables, but manages them electronically for user convenience.
    e. The RDP Table and eRDPML include detailed guides on how to use them.

D. Planning Dives With Your Computer

- ***What are four advantages of dive computers over dive tables?***

1. Almost all active divers use dive computers, and they're considered standard equipment in most areas. Although dive tables are effective (diving has been around a lot longer than dive computers), there are four advantages that make dive computers far more popular.
    a. Dive computers are easier to use than tables.
        - Tables are not difficult to use, but dive computers are easier in that they are more convenient.
        - Although computers do much of the work, you nonetheless control and remain aware of your depth and time limits.
    b. Dive computers help offset human error.
        - Your computer gives information based on the dive you actually make. Although it shouldn't happen, if you accidentally exceed your planned depth or time, your computer knows and adjusts its calculations accordingly.
        - Dive computers record your dive information, which allows you to put accurate details into your dive log later.

c. Dive computers give you more time underwater. As discussed, dive computers give you more no stop dive time on a multilevel dive.
    - The deeper you dive, the more additional no stop time you get on a multilevel dive.
    - As mentioned, the eRDPML allows you to plan multilevel dives, too, but it is not as convenient and versatile as a dive computer.

d. Besides the basic information you need while diving, most dive computers have other features. These range from recording the water temperature to being able to download your dive information to an electronic dive log.

- ***What seven types of information do dive computers tell you before, during and/or between dives?***

2. Virtually all dive computers provide the following information before, during and/or between dives (most of these have been discussed):
    a. No stop (no decompression) limits. You use these to plan your dives.
    b. Depth. During the dive, your computer always shows your current depth.
    c. Elapsed time. Underwater, your computer shows how long you've been down. Between dives, it shows the duration since you surfaced from the previous dive.
    d. No stop time remaining. You always know how much time you have left at your present depth.
    e. Ascent rate. Ascent rate indicators range from visual "speedometers" to simple alarms that go off if you ascend too fast.
    f. Emergency decompression. If you exceed a no stop limit, your computer calculates the stops you have to make (more about this in Knowledge Development Section Five).
    g. Previous dive information. You can recall the maximum depth and total dive time for the last dive. Most computers will let you do this for several of the previous dives, in reverse order, and provide additional information.

- ***How do you set up and activate your dive computer? What is the first step?***

3. Before you dive with a computer, you need to set it up and activate it.
    a. The first step is to read the dive computer manual. If you don't have it available, you can often download it from the manufacturer's website.
        - Computers are very similar, but they have their individual characteristics.
        - It is your responsibility to read and understand the manufacturer's instructions.
    b. Setup involves settings that you usually only make once. Following the manufacturer guidelines, these may include:

- Time and date
- Metric or imperial system measurements
- Ascent rate alarm (you usually leave this on)
- Maximum depth/time alarm (to warn you if you reach a limit)
- If you're unsure about a setting even after consulting the manufacturer literature, see your instructor. Usually, the best practice is to leave it at its default setting.

c. To activate your computer before diving (or to scroll the no stop limits) you usually press a button or touch some contacts.
   - Check the time and date after activating it. You may want to reset these if you changed time zone, etc.
   - Be sure there is not a low battery warning.
   - Virtually all modern dive computers self-activate if you forget to do so (or they go back to sleep) before you dive. However, best practice is to activate your computer.

- ***How do you plan dives with your dive computer?***

4. For most recreational dives, planning with your computer is simple, whether making your first dive or a repetitive dive.
   a. Activate your computer and scroll the no stop limits.
   b. Agree with your buddy on a maximum depth based on the no stop times displayed. Check the time for that depth.
      - If your dive will be mostly at the deepest depth, then your allowable dive time will be close to the time shown. If you ascend (multilevel dive), you will have more time than displayed for the maximum depth.
      - Repetitive dives have shorter no stop times than your first dive. If you want to dive longer than the no stop time shown for your planned maximum depth: make a multilevel dive; make a shallower dive; stay at the surface longer (if making a repetitive dive.)
      - On multilevel dives, it is generally recommended that you plan to descend relatively quickly to the maximum depth, then gradually work your way shallower. This gives you the most no stop time and makes most of the dive part of a long, slow, conservative ascent.
   c. Plan your maximum time.
      - On a shallow dive or multilevel dive, you usually have more no stop time available than the length of time your air supply will last.
      - Agree with your buddy on a time to head back toward your exit, and to begin ascending to the surface.
   d. Plan your air management as you have already learned.

- Don't forget that your air supply commonly limits your dive. Watch your SPG as well as your dive computer.
- Turn the dive based on what you reach first: time, air supply turn point or remaining no stop time. Note these, as well as no stop time for the maximum and next deeper depths, on the PADI Skill Practice and Dive Planning Slate for reference during the dive.

E. Diving With Your Computer

- ***What are six guidelines for diving with a computer?***

1. Follow these six guidelines when diving with a computer (you should recognize most of them):
   a. Dive the plan.
      - Don't exceed your planned depth or time just because your computer will let you.
      - But, never hesitate to make your dive shorter or shallower if the situation makes it appropriate.
   b. Stay well within your computer's limits.
      - Letting your no stop time get to or near 0 is "pushing" the limits – an unwise practice. This applies even if your computer shows ample no stop time when you ascend to a shallower level.
      - Always have ample no stop time showing. Head shallower before your computer nears 0 minutes remaining.
   c. Follow the most conservative computer – yours or your buddy's.
      - Your and your buddy's computers should have similar readings, but they won't be identical.
      - Head shallower or end the dive (as appropriate) based on whoever's computer nears a limit first.
   d. Watch your SPG.
      - As mentioned in the previous discussion, check your air supply, not just your no stop time remaining.
      - A good habit is to check both of them together.
      - Air integrated computers (computers with the SPG built into them) make it easy to check both together. Many of these track your air use and predict your time remaining based on how fast you've been breathing and your present depth.
   e. Start at your deepest point and progress shallower. When making more than one dive, plan to make the deepest dive first, with successive dives to the same depth or shallower.
      - Generally, avoid large increases in depths after ascending to a shallower depth.
      - Minor increases and decreases aren't an issue.
      - The principle of deep-to-shallow gives you the most no stop

time, and is considered more conservative because most test data are based on deep-to-shallow dives.

f. Ascend slowly, well within your computer's ascent rate, and make a safety stop at 5 metres/15 feet for three minutes or longer.

- ***What should you do if your dive computer fails during a dive or between dives?***

2. Dive computers are highly reliable and failure is very, very rare.
   a. Most computers check themselves when you activate them and confirm adequate battery power for 12 to 24 hours (see the manufacturer's info on this).
      - Failures generally cause a computer to display nothing, or display nonsense. Bad information is very rare.
      - A failed computer may appear to be working later. This is rarely true; computers don't fix themselves. Have a faulty computer serviced before attempting to use it again, even if it seems fine.
   b. If your computer fails during a dive, you have two options.
   c. Option 1: Signal your buddy, ascend, make a safety stop and end the dive. If you're remaining well within limits throughout the dive, you should surface within accepted limits.
      - After surfacing, you must wait 12 or more hours (see the manufacturer recommendations) for your nitrogen levels to return to normal before diving again with a different computer.
      - If you're recording your dive depths and times (as you should), you may be able to continue to dive by applying all the information to dive tables. However, multilevel no stop times commonly exceed table limits, so this may not work.
   d. Option 2: Continue the dive using a backup computer. Dive computers are inexpensive enough that more and more commonly, avid divers have two. Recall that to use this option, you must dive with both computers at all times, and stay within the limits of the most conservative one.
      - A double computer failure is highly unlikely; you can continue the dive and make repetitive dives with your backup. If the backup were to fail, though, use Option 1.
   e. If your computer fails between dives during a surface interval and you have not been diving with a backup:
      - You may be able to use tables to continue diving, as described above.
      - Otherwise, wait 12 or more hours (see the manufacturer recommendations) for your nitrogen levels to return to normal before diving again with a different computer.

IV. The Underwater World's Ambassador

A. Threats to the Underwater Environment

- ***Are divers a significant threat to the overall health of the underwater environment?***

1. Divers can damage fragile aquatic organisms if they're neglectful and use poor techniques. However, divers are not a significant threat to the overall health of the underwater environment.
2. The significant threats are pollutants, climate change, dredging, the loss of mangroves and the spread of invasive species (among others).
3. The types of damage divers cause through poor technique are localized and do not threaten ecological survival.
    a. Injury and death of fragile organisms occur due to impacts and contact in nature even without divers present.
    b. Even with diving's growth and popularity, it isn't expected that an underwater environment could be destroyed simply due to diving activity.
4. Some intentional interactions by some divers can have serious environmental consequences.
    a. Underwater hunting without restraint and limits in the 1960s and 1970s showed divers can depopulate important species from large areas. Some of these species are only now recovering in these areas.
    b. Obviously devastating effects result from using toxins to catch fish (once common for the aquarium trade) and similar actions.
    c. Damage to wrecks and other cultural resources, such as intentionally removing artifacts, can destroy the archaeological value and leave the site less desirable for other divers. Countries have closed or greatly restricted diving due to this.

B. Applying Environmentally-friendly Dive Skills

- ***Why is it important to apply environmentally-friendly dive skills and awareness while underwater?***

1. Although divers aren't a significant threat to the overall health of the aquatic environment, it is nonetheless very important to apply environmentally-friendly dive skills and awareness while underwater, for several reasons.
2. Diver damage may not (by itself) cause an ecosystem to collapse, but it can destroy its natural beauty. Minimizing your effect on the environment is important in leaving the places you visit beautiful for your next visit and for divers who follow.
3. An ecosystem already under stress from pollution and other sources may struggle to recover from – or be unable to recover from – damage caused by divers (or any other sources). For example, a gouge caused by

a dragging console may be something a coral head would repair over a few months in healthy, pristine conditions. But, in less than optimum conditions (increasingly widespread), the same injury could become a foothold for disease that eventually overcomes and kills the entire coral head.

4. Dive skills and habits that are good for the environment are also good for you. You cause less damage to your gear, save energy and reduce the risk of hazardous aquatic life injuries if you stay streamlined, properly weighted, control your buoyancy and swim well above the bottom.
5. Diving without damaging is important to your influence as role model and an ambassador for the underwater world.
    a. As society struggles to solve environmental problems, the ability to provide perspective and constructive insight becomes increasingly important.
        - Similarly, not damaging or defacing wrecks or other artifacts of our history and cultural heritages is important in keeping sites like these worth diving, and in keeping them open to diving.
    b. Because you see it first hand, you can influence your nondiving peers to help preserve and protect the aquatic world.
    c. But, diving will lose this influence if people perceive diving is damaging. It would make divers appear hypocritical.

C. Your Role as a Diver

- ***What role do you have as a diver in the long-term survival and health of the world's aquatic ecosystems?***

1. Your influence as a diver gives you a role as being part of the solution to the problems facing the long-term survival and health of the world's aquatic ecosystems.
2. You may be one of the first witnesses to what's happening in aquatic ecosystems.
    a. You can report your observations by taking part in environmental surveys and reporting observations online. Visit projectaware.org for more information.
    b. Even diving "just for fun," if you observe something alarming, you can report it to the appropriate authorities or experts.
3. You have credibility as the aquatic world's ambassador.
    a. When you tell people about what's happening underwater, you do so as someone who sees it. Many people who work or recreate on or around water don't witness what's happening below.
    b. Adding your voice and votes to those of other divers helps direct positive changes. Diver-support has already helped steer and further initiatives to protect environments and preserve endangered species.

4. You have the power to take direct action. Examples include:
    a. Underwater cleanups. Organized by PADI operators and other groups, these are social events that not only remove, but document trash and litter to further efforts to reduce them at their sources.
    b. Invasive specifies removal. In some locations, divers are authorized to remove invasive species (organisms not native to the environment that have taken hold after being transferred there by human activity).
    c. Ecotourism and science. Several organizations and scientists rely on volunteer divers in gathering data. While some of these require substantial expertise, many do not.
5. To learn more about how you can help in preserving the underwater world, see your PADI operator and visit projectaware.org.

V. Your Skills as a Diver 4

[NOTE: Briefly review the skills student divers will learn during the fourth confined water dive.]

A. Deep water entry

B. Helping a tired buddy

C. BCD oral inflation underwater

D. Neutral buoyancy – visual reference descents, swimming and ascents near sensitive environments

E. No mask swim

F. Freeflow regulator breathing

G. BCD oral inflation underwater

H. Skin diving skills

I. Exit – Remove scuba kit in the water

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Knowledge Development Five

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Outline

I. Using Dive Computers and Tables 2

A. Planning a Minimum Surface Interval

- ***Why would you need to find a minimum surface interval?***

1. When making two or more dives, you commonly plan your dives by seeing what your no stop times are after your surface interval.
   a. You decide how long you want to dive and choose your maximum depth based on the no stop times, or you choose your desired depth and plan your time.
   b. When you can plan multilevel dives, you have more flexibility, of course.
2. Sometimes, you want to make a repetitive dive to a specific depth for a specific time.
   a. Your objective may be at a very specific spot, and you need a minimum time to do it, such as photographing your buddies next to the ship's bell on a wreck at 18 metres/60 feet.
   b. When the dive site is single depth (i.e., you won't be able to gain time by ascending to a shallower depth), you may simply want enough time to make the dive worth it.
   c. Planning a repetitive dive for a specific depth and time is called finding a minimum surface interval.
      - This simply means that to dive to a desired depth for a given time, you need to figure out how long you need to wait after the first dive to have the desired no stop time at the planned depth of the repetitive dive.
   d. *Example:* You and your buddy are planning a repetitive dive to 15 metres/50 feet. The bottom will be relatively flat, so you can't plan a multilevel dive to get any meaningful increase in no stop time.
      - Based on experience, you know that with a full cylinder, you can dive to that depth for about 50 minutes, ascend, make a safety stop and surface with 50 bar/500 psi reserve.
      - You and your buddies decide that you want at least 45 minutes of no stop time so you can enjoy a reasonably long dive within your air supply limit.
      - Sticking to conservative dive practices, you also want your dive to be well within the no stop limits.
      - You and your buddy decide you want a surface interval that gives you a no stop time of at least 55 minutes at 15 metres/50 feet.
   e. It's a good idea to plan your surface interval to be longer than the absolute minimum.

- This is consistent with diving well within your dive computer or dive table limits.

- ***What are three ways you can find a minimum surface interval with a dive computer without using dive tables?***

3. There are three ways commonly used to find a minimum surface interval with a computer.
   a. Wait and check.
      - After your dive, scroll your no stop times and check the no stop time for your planned repetitive dive depth.
      - If the scrolled time is too short, keep rechecking until you've been at the surface long enough to have the desired no stop time, plus some extra so you stay well within the limits.
      - Although this method sounds imprecise, with experience you'll get a feel for about how long you have to wait.
      - Notice during a surface interval, at first your repetitive no stop times increase quickly, but the increase rate gradually declines as the interval gets longer.
   b. Use the dive computer plan mode.
      - Some higher-end dive computers have a sophisticated plan modes that allow you to enter a surface interval. The computer tells you what the no stop time will be after you've been up that long.
      - If your computer has this feature, enter surface intervals (may take a bit of trial-and-error) to find out how long you need to wait to have the desired no stop time, plus extra time so you're well within limits, at your planned depth.
      - See the manufacturer literature, website or your instructor for specifics on how to use this function with your specific computer.
      - Not all dive computers have this option.
   c. Use a tablet/smart phone app.
      - There are dive planning apps that calculate no stop times (they're used commonly in tec diving).
      - With such an app, you enter your first dive maximum depth and time, a surface interval and the desired second depth and time.
      - If the app shows that the second dive requires decompression stops, enter longer surface intervals until it shows the desired no stop time, plus a margin for being conservative, at the planned depth.
      - Your app probably won't exactly match your dive computer, but it will give you a good approximation. Be sure to scroll your computer's no stop times before diving to confirm you have the time you want.

- ***How can finding minimum surface intervals with the RDP Table and eRDPML help you plan them with dive computers?***

4. Finding minimum surface intervals began with dive tables. You can use the RDP Table or eRDPML to find minimum surface intervals.
    a. Like using an app, don't expect the times to exactly match your dive computer, but you will get a good approximation. Again, scroll your computer's no stop times before diving.
    b. If the first dive was a multilevel dive, you may not be able to use the RDP Table because it treats dives as single depth. The eRDPML is generally more useful, but you need to track your depth levels and times to do this.
    c. Finding minimum surface interval is in the Instructions for Use included with the RDP Table and eRDPML. Your PADI Instructor can also help you.

B. Flying After Diving and Altitude Diving

- ***Why is going to altitude after diving a potential issue?***

1. In Knowledge Development Four, you learned that you need to keep the excess dissolved nitrogen in your body tissues within accepted limits. Failure to do so may allow the nitrogen to come out of solution and form the bubbles that cause decompression sickness.
    a. The decompression models used in most dive computers and tables are based on surfacing from your dives and making your surface intervals at sea level.
    b. Going to a higher altitude reduces the pressure around you at the surface. This means that dissolved nitrogen would come out of solution faster than at sea level.
    c. Going to altitude after diving is therefore a potential issue because the pressure reduction can increase the risk of DCS. If you will be flying after diving (or going to altitude by driving over a mountain pass, etc.), or diving at altitude (in a mountain lake), you follow special recommendations and procedures to account for the reduced pressure.

- ***How do flying after diving and altitude diving differ?***

2. Flying after diving and altitude diving differ, so they have different recommendations and procedures.
    a. Flying after diving (or ascending to altitude after diving) – you start and end your dive at sea level (normal surface pressure), and then go to altitude (lowered surface pressure).
    b. Altitude diving – you start and end your dive at altitude (lowered surface pressure).

- ***What are the current recommendations for flying after diving?***
- ***How do you keep up with the recommendations for flying after diving?***

3. At this writing, the dive medical community's recommendations for flying after diving are:
   For no stop dives:
   - Single dives (no repetitive dive) – A minimum preflight surface interval of 12 hours is suggested.
   - Repetitive dives or multiday dives (diving every day for several days in a row) – A minimum preflight surface interval of 18 hours is suggested.
   - Dives requiring emergency decompression stops – A minimum preflight surface interval greater than 18 hours is suggested.

   a. As with dive computers and tables, no flying after diving recommendation can guarantee that decompression sickness will never occur.
   b. These guidelines represent the best estimate presently known for a conservative, safe surface interval for the vast majority of divers. There always may be an occasional diver whose physiological makeup or special dive circumstances result in decompression sickness despite following the recommendations.
      - These recommendations are based on a cabin altitude pressure range of 600-2400 metres/2000-8000 feet.
   c. You're responsible for your own dive safety and behavior. Flying after diving recommendations change as we learn more about how pressure changes affect the body; stay current and follow the most current recommendations (you can find them at diversalertnetwork.org and other websites).
   d. There are presently no recommendations for driving to altitude after diving, so the prudent practice is to be conservative.
      - The longer the interval between diving and ascending to altitude, the lower the risk.
      - In areas where driving to altitude is common, local divers may have a procedure they use.
      - Some divers use the flying after diving recommendations for driving to altitude.

- ***Above what altitude do you need to use altitude diving procedures?***

4. With most dive computers and dive tables (including the RDP Table and eRDPML), you need to use altitude diving procedures if diving at an elevation of 300 metres/1000 feet or higher.
   a. Altitude diving procedures with your dive computer vary. Some automatically adjust, some have settings you use and others cannot be used at altitude (see the manufacturer literature).

b. To use most tables (including the RDP Table and the eRDPML) at altitude, you use a special table that converts your actual depth to a theoretical depth that adjusts for the pressure difference.

c. If you're interested in altitude diving or will be diving at altitude locally, you can learn the procedures in the Altitude Adventure Dive in the Advanced Open Water program, or in the PADI Altitude Diver course.

C. Cold and/or Strenuous Dives

- ***Why are being cold and/or exerting yourself strenuously issues with respect to decompression sickness risk?***

1. You've already learned that you need to avoid overexertion and hypothermia while diving.
2. Besides what you learned previously, if you get cold or exercise a lot during a dive, you may end the dive with more dissolved nitrogen than calculated by your dive computer (or tables). This is thought to increase your DCS risk.

- ***What should you do if you are cold or exert yourself strenuously on a dive?***

3. If you are cold or exert yourself strenuously during a dive, be more conservative.
   a. Stay well within the no stop limits, being even more conservative than normal. There should always be plenty of no stop dive time remaining throughout the dive.
   b. Some computers allow you to set them to be more conservative, though you usually have to do this before the dive. See your instructor or the manufacturer literature on how to do this if possible with your unit.
   c. With the RDP Table and the eRDPML, you plan cold/strenuous dives as though they are 4 metres/10 feet deeper than their actual depth.
   d. Safety stops are recommended after all dives, but they're especially prudent after a cold and/or strenuous dive.

D. Emergency Decompression Stops

- ***When do you need to make an emergency decompression stop?***

1. In Knowledge Development Four, you learned that if you exceed a no stop limit, you will have to make one or more emergency decompression stops.
   a. Unlike safety stops, emergency decompression stops are required so that you don't exceed accepted theoretical nitrogen levels.
   b. In recreational diving, required stops are for emergency situations only.

- Emergency decompression stops mean you either failed to monitor your dive computer (or timer and depth gauge), or something forced you to overstay your time at depth.
- Failure to monitor doesn't have to happen (it's your responsibility). Circumstances that keep you from starting your ascent are exceptionally rare.
- In recreational diving, more than one required decompression stop would be highly unlikely, but it could happen if a diver grossly exceeds no stop limits.

- ***How do you determine the depth(s) and time(s) of emergency decompression stop(s)?***

2. If you exceed your computer's no stop times, it will go into decompression mode.
   a. Decompression mode guides you by telling you the stop depth and how long you have to stay there before you can ascend to the surface (or the next stop if there is more than one).
      - Don't ascend above the stop depth. You may be slightly deeper.
   b. Computers differ in how they display emergency decompression information. See the manufacturer literature for the particulars for your dive computer.
   c. You can find the RDP Table and eRDPML emergency decompression procedures printed on each and in the Instructions for Use that come with them.

- ***What should you do if you surface from a dive without making a required emergency decompression stop?***

3. If you don't have enough air to complete an emergency decompression stop or accidentally skip one:
   a. Stop as long as you can, but save enough air to surface and exit safely. Use some of your reserve if you must – this is an emergency, and that's why you have a reserve – but don't run out underwater trying to make the stop.
   b. Discontinue diving for at least 24 hours. Many dive computers will go into an error mode and lock up, not allowing a dive for that long or longer.
   c. Relax, breathe 100 percent emergency oxygen if available and monitor yourself for decompression sickness symptoms.

E. First Aid and Treatment for Decompression Illness

- ***What is meant by decompression illness?***

1. Lung overexpansion injuries and decompression sickness can produce very similar signs and symptoms, even though they result from different causes.

a. The first aid for both is the same, so you don't need to distinguish between them.
b. For simplicity in dealing with diver emergencies, the dive community groups both lung overexpansion injuries and decompression sickness under the term decompression illness (DCI).

- ***What is the first aid for a diver with suspected decompression illness? What treatment is usually required?***

2. If a diver is suspected of having decompression illness:
   a. The diver should discontinue all diving.
   b. Monitor breathing, providing CPR as needed.
   c. Contact emergency medical care. As you learned in Knowledge Development Three, some areas have diver emergency services that you contact for consultation and to coordinate with the local medical service.
   d. Keep the diver lying down and provide emergency oxygen.
   e. Monitor the diver and take steps to prevent shock.
   f. If the diver is unresponsive and breathing, lay the diver level, left side down, head supported, breathing oxygen (as discussed in Knowledge Development Three.)
   g. Continue providing this care until emergency medical personnel arrive.
3. Almost all cases of decompression illness require treatment in a recompression chamber. Recompression puts the diver under pressure, which helps the body absorb the bubbles. The pressure is then lowered very slowly over many hours.
4. Don't delay first aid and getting the diver to treatment. The faster treatment begins, the lower the risk of permanent residual symptoms.
5. As you learned in Knowledge Development Three, the PADI Rescue Diver and Emergency Oxygen Provider courses, and the Emergency First Response Primary and Secondary Care courses, are recommended for learning more about managing diver emergencies.

II. Being a Diver 5

A. Gas Narcosis

1. Knowledge Development Four discussed contaminated air, oxygen toxicity and decompression sickness. The fourth issue related to the component gases in air is gas narcosis.

- ***What are the signs and symptoms of gas narcosis?***
- ***What potential hazard does gas narcosis present?***

2. Many gases, including oxygen and nitrogen, produce an intoxicating effect under pressure. This is called gas narcosis.
    a. The signs and symptoms of gas narcosis include:
        - Feeling intoxicated
        - Loss of coordination
        - Slowed thinking
        - Slowed reactions
        - Inappropriate laughter
        - Depression
        - False sense of security
        - Ignoring or disregard for safety
        - Anxiety and/or panic (when under stress at depth)
    b. Gas narcosis is not thought to be dangerous itself. The hazard is that it impairs the good judgment, clear thinking and timely responses you need to avoid and manage problems underwater.
    c. Note that at one time, it was common to call gas narcosis nitrogen narcosis.
        - It was thought that only nitrogen caused narcosis. Today physiologists consider oxygen about as narcotic (hence, EANx doesn't have a gas narcosis advantage).
        - However, some gases are not narcotic. Tec divers breathe gas mixes with helium to reduce the proportions of nitrogen and oxygen. This helps them manage narcosis, but this is beyond the scope of, and not necessary for recreational diving. (Helium has its own drawbacks.)

- ***Generally, what causes gas narcosis?***
- ***At what depth do most divers usually begin to notice gas narcosis?***
- ***What factors may influence susceptibility to gas narcosis?***

3. Gas narcosis is thought to be caused by the increased amount of dissolved gases in body tissues slowing the transmission of nerve impulses. It slows the communication between the brain and the body, and between different parts of the brain.
    a. Breathing air (or EANx), most divers begin to notice narcosis at approximately 30 metres/100 feet.
    b. Narcosis varies, however, from individual to individual and in the same diver from one dive to the next.
        - Being tired, dehydrated or generally fatigued may make narcosis noticeable shallower.
        - Some prescription and some over-the-counter drugs combine their effects with narcosis in producing intoxication (this is another reason why you don't use alcohol and certain drugs before diving).

- Cool water, darkness and limited visibility seem to increase narcosis (though it may be the added stress simply makes a given effect more noticeable).
- Diving experience seems to reduce the effects of narcosis – you learn to compensate for its effects.

- ***How do you avoid gas narcosis? What do you do if it occurs?***

4. You avoid gas narcosis by not diving too deep.
   a. For most people, assuming no predisposing factors, gas narcosis isn't likely to be a concern diving as deep as 30 metres/100 feet (as a new PADI Open Water Diver, you're qualified to a maximum of 18 metres/60 feet).
   b. Recreational divers with further training and experience can qualify to dive as deep as 40 metres/130 feet (the maximum depth for recreational diving).
   c. If you experience narcosis, immediately ascend to a shallower depth. Continue the dive at a shallower depth, or abort the dive.
      - Narcosis generally fades quickly when you return to a shallower depth.
      - If your buddy appears or acts "narked," escort your buddy to a shallower depth.

B. Finding Your Way

- ***What are five benefits of navigating underwater?***

1. During your open water dives, you will learn and practice basic underwater navigation with a compass. Navigating underwater has five benefits, because it
   a. helps you plan your dive so you don't waste air trying to find the best parts of the dive site.
   b. allows you to avoid surface swims by navigating to your ascent/exit point underwater.
   c. helps you take the shortest route to the boat or shore if you have a problem.
   d. lets you avoid certain areas if necessary, or stay within a certain area.
   e. reduces stress, because you're less concerned about how far you are from your exit/ascent point.

- ***What four basic features does an underwater compass have? What is the purpose of each?***

2. A standard underwater compass has four basic features you use when navigating underwater (we'll look at electronic underwater compasses shortly).
   a. Magnetic north needle – This is a needle (or an arrow printed on a card) that can rotate so it always points to magnetic north (provided

the compass is level and not too close to something made of steel or iron).

- The north needle is the basis for compass navigation because you know that it is always pointing in the same direction.
- Compass navigation is based on determining other directions relative to the north needle's known direction.

b. Lubber line – This is straight line through the center of the compass face or along the side from the 6 o'clock to the 12 o'clock positions.

- The lubber line is always your direction of travel.

c. Bezel with index marks – The bezel rotates so you can align two, small parallel marks over the north needle.

- As you'll see, this helps you maintain a straight line while navigating.
- Some compasses have two sets of index marks. The second set is 180º from the first. This lets you set a return (reciprocal) course without having to reset the compass.

d. Heading references – Most compasses have numbers to record your heading (your travel direction, measured in degrees from magnetic north).

- Some compasses have detailed markings (a mark every two degrees, whereas others may only have 0º, 90º, 180º and 270º.
- More detail gives you more precision; you may record headings on your slate and in your dive log for reference when returning to and relocating a site.

- ***How should you hold a compass when navigating with it underwater?***

3. Before getting into how to set your compass, let's look at how you hold it.
   a. Properly holding and positioning your compass is important for swimming in a straight line.
   b. Hold your compass so it's relatively level (so the north needle can rotate) and the lubber line is aligned with the centerline of your body.
   c. Wearing the compass on your wrist, hold the arm without the compass straight out. Grasp it with your other hand near the elbow, putting the compass straight in front of you.
   d. With a console, hold the compass squarely in front of you with both hands.
   e. With either method, lock your arms and look over the compass, not down on it, so you can watch where you're going.

- ***How should you set a compass to navigate a straight line from one point to another? How should you set it to return along the same line (reciprocal heading)?***

4. To navigate a straight line from one point to another (typically, from where you are in a desired direction or toward a known destination):
    a. Hold the compass as you just learned with the lubber line pointed in your desired travel direction.
    b. Let the north needle settle on magnetic north, then rotate the bezel until the index marks straddle the needle.
    c. Continuing to hold the compass properly, swim along the lubber line keeping the needle in the index marks.
        - If you start to turn off course, the needle drifts outside the marks, cuing you to correct your direction. Don't move your arms – turn your body – to return to the correct course.
        - Typically, one buddy in the team navigates, while the other buddy maintains contact and watches the depth. Buddies continue to communicate as they do this, and not let themselves get so focused on navigation or depth that they don't pay attention to each other.
    d. To set a reciprocal heading so you return along the same line, rotate the index marks 180 degrees. Turn until the north needle is within them; you are now facing the way you came.
        - As mentioned, some compasses have reciprocal index marks. If yours does, don't move the bezel. Simply turn until the north needle is within the reciprocal index marks.

- ***How should you use an electronic compass to navigate?***

5. Some dive computers have electronic compasses built into them.
    a. Electronic compasses vary in how they display and how you read them. Check the manufacturer literature for specifics on yours if your computer is equipped with one.
    b. With many electronic compasses, you hold the compass squarely in front of you as previously described and face directly into your desired travel direction.
        - The compass shows you the heading (0º to 359º).
        - Continuing to hold the compass squarely in front of you, swim keeping the same heading showing.
        - If the number changes, you're turning off course; turn until you're back on your heading.
        - To set a reciprocal course, if your original heading is 179º or less, add 180 degrees to find the reciprocal heading. If your original heading is 180º or more, subtract 180 degrees.
        - Some electronic compasses have other functions for assisting with navigation.

C. Continuing Your Adventure

- ***What is a Course Evaluation Questionnaire?***

1. After you complete your certification as a PADI Open Water Diver, you may receive a Course Evaluation Questionnaire from a PADI Office. Answering the questions on it may be one of your first contributions to the dive community as a new diver.
    a. The questionnaire is a survey that allows the PADI Offices to recognize outstanding performance by instructors, as well as to verify that the course included certain training elements.
    b. It helps maintain the quality of professional diver education by identifying individuals and methods that work well, and by allowing corrections when problems are discovered..
    c. Please take a moment to answer the Course Evaluation Questionnaire when you're invited to do so.
    d. If you don't receive a questionnaire but would like to complete one, you can request one on padi.com.

- ***What are your limits as a PADI Open Water Diver?***

2. Throughout this course, you've learned about the limits recommended for you as a newly certified PADI Open Water Diver. Let's summarize some of them:
    a. You were trained to a maximum depth of 18 metres/60 feet (or the actual depth you reached, if shallower).
    b. With additional experience and training beyond the Open Water Diver course, the maximum depth for recreational diving is 40 metres/130 feet.
    c. You're also qualified to dive in conditions as good as, or better than, those in which you trained, within the no stop limits of your dive computer or tables.
    d. You can enroll and participate in the PADI Adventures in Diving program, Discover Local Diving program and many (but not all) PADI Specialty Diver courses.
    e. Ultimately, it is your responsibility to set your limits for each dive based upon your assessment of your skills, comfort level and the dive conditions.

- ***How do you stay involved with diving? What are your options for continuing to learn as a diver?***

3. Often, the biggest challenge new divers face is staying involved with diving after certification. You may already be thinking about this.
    a. This problem has been studied. The dive community has found that three things consistently keep divers involved with diving:

- Social settings that allow divers to meet other divers who become buddies
- Going different places to dive
- Setting training goals and continue to dive by continuing their diver education

b. It's not hard to meet and make friends with people who dive. Here are some suggestions:
   - Stay connected with your PADI Dive Center or Resort, which is a social hub for divers in your area.
   - Exchange emails and phone numbers with people you meet on dive trips and in different courses.
   - Join your dive operation's dive club and attend social events. Participate with specialized dive groups that focus on your passion, like underwater photography or wreck diving.
   - Take part in group dive travel.
   - Meet new divers and make new friends at ScubaEarth.
   - You can also meet new divers at broad social sites like Facebook and Google +.
   - Attend events like dive shows and underwater film festivals.
   - Bring your nondiving friends to your dive operator and get them diving, too.

c. To go different places to go diving, you don't have to plan dive trips by yourself.
   - Your PADI Instructor or dive operation likely organizes local and distant guided dive outings and trips.
   - Virtually all dive clubs and many online social groups also host dive outings in which you can participate, and often, your local PADI Dive Center or Resort is part of hosting or promoting them.
   - With experience, you may want to start planning more individualized diving (for you and a spouse or a couple of friends who are certified divers, etc.). Your dive operator can help you arrange this type of outing as well.

d. Continuing your education expands your opportunities and growth as a diver.
   - Set goals about what you want to accomplish as a diver. Having training goals makes each course a step toward what you want to accomplish as you increase your dive opportunities.
   - Most of your continued training as a diver involves open water diving – not confined water/pool. Continuing education is a great way to gain diving experience while learning new skills.
   - You can begin all PADI core courses and a growing number of other PADI programs and specialties online at any time with PADI eLearning.

- Additional training expands your qualifications, making it possible to participate in new environments and/or activities.
- Your PADI Instructor may offer courses in connection with dive travel and social events, so they're also opportunities to visit new places and meet people who want to dive with you.

e. Besides social interactions, dive outings and diver education, it has also been found that divers who invest in a BCD, regulator and instruments package, and/or an exposure suit, tend to stay in diving. There are at least three reasons why:
   - Having your own gear is part of the fun of diving because it's the gear you prefer and is adjusted for you.
   - Divers who have their own equipment (beyond mask, fins and snorkel) dive more frequently, at least partly because it's more convenient and more enjoyable to use your own stuff.
   - Having different types of gear opens more diving to you. For example, in climates with wide seasonal water temperature changes, divers who have both wet suits and dry suits have the longest dive seasons.

- ***What is the purpose of the PADI System of diver education?***

4. The purpose of the PADI System of diver education is to help you to continue to enjoy diving. It does this by addressing your interests and by providing a clear path to follow to reach your training goals, with choices, for growing in and enjoying diving.
   a. As mentioned, during different courses, you have opportunities to make new diving friends, discover what types of kit you like, learn new skills that open the door to new adventures, and visit new places.
   b. The PADI System provides the structure for getting comprehensive, valid training that takes you where you want to go in diving.
   c. Use the PADI System of diver education flow chart for a graphic view of your training options and paths. Ask your PADI Instructor, Dive Center or Resort about the schedules for the courses that interest you. Visit padi.com regularly for updates and additions to the PADI System.
   d. The PADI Adventures in Diving program develops your open water skills.
      - The PADI Advanced Open Water Diver course includes deep diving, underwater navigation and three Adventure Dives that you and your instructor choose together. The PADI Adventure Diver course gives you a choice of any three Adventure Dives.
      - Adventure Dives let you try out different underwater activities including underwater photography, night diving, wreck diving, search and recovery, altitude diving, boat diving, drift diving, dry suit diving, underwater nature and more.

- At the instructor's discretion, Adventure Dives may credit toward the entire specialty course.
- Most divers complete the Advanced Open Water Diver program in two days (commonly over a weekend).
- After earning your Advanced Open Water Diver certification (or Adventure Diver with the Underwater Navigation Adventure Dive), you qualify to begin the PADI Rescue Diver course (discussed in Knowledge Development Three and Four).

e. The PADI Rescue Diver course builds on the diver emergency prevention and management skills you master in the PADI Open Water Diver course.
   - You practice adapting rescue techniques to your personal characteristics, and learn to coordinate with other divers working together to handle problems.
   - Although the subject is serious, many divers name the PADI Rescue Diver course as one of the most rewarding challenges on their training goal path.

f. PADI Specialty Diver courses qualify you in the same activities covered by the Adventure Dives, and many more.
   - Most PADI Specialty Diver courses have two to four dives; you can complete most of them in a couple of days.
   - The certifications you earn in specialties like PADI Enriched Air Diver and Cavern Diver are required for safety reasons by the dive community to participate in those activities.
   - Certification in other specialties, like Underwater Photographer, is not required, but these courses allow you to get up to speed enjoying such activities more quickly.
   - Earn the PADI Advanced Open Water Diver certification, five PADI Specialty Diver certifications and the PADI Rescue Diver certification, and you qualify as a PADI Master Scuba Diver after you have 50 logged dives – the highest nonprofessional level rating in recreational diving.

g. As you learned earlier, if you are away from diving for an extended period, the Scuba Review program is available to refresh your knowledge and skills under instructor guidance. (You can start online with PADI eLearning at any time.)

h. The Emergency First Response program trains you in CPR and first aid following the same protocols used (at a lay level) by emergency medical personnel. This isn't specifically a diver program, but these are good skills to have and you need them for Rescue Diver.

i. PADI Rebreather Diver teaches you to use Type R (recreational) rebreathers – scuba equipment that recycles your breathing gas – for recreational, no stop diving.

- Rebreather diving is growing in popularity, especially among underwater photographers and nature enthusiasts.
- Rebreathers are very quiet (you can get close to fish) and offer longer dives than conventional scuba, but there are important considerations in using them.
- You need to complete the PADI Enriched Air Diver course before enrolling in PADI Rebreather Diver (you're breathing enriched air with a rebreather).

j. A surprising number of brand new divers know immediately that they want to continue into the professional ranks, perhaps all the way to PADI Open Water Scuba Instructor.

- See your instructor about the PADI Divemaster course (you qualify to begin the course as a PADI Rescue Diver with 40 logged dives and training in the Emergency First Response program).
- Ask your dive operator or visit padi.com for an overview of the PADI Instructor Development Course and Examination.

III. Your Skills as a Diver 5

[NOTE: Briefly review the skills student divers will learn during the last confined water dive.]

A. Remove and replace the scuba kit underwater

B. Remove and replace weight system underwater

C. Descents and ascents without reference

D. Minidive

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